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LAND RESOURCE REGIONS AND MAJOR LAND RESOURCE AREAS OF THE UNITED STATES

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SOIL CONSERVATION SERVICE • U.S. DEPARTMENT OF AGRICULTURE

LAND RESOURCE REGIONS AND MAJOR LAND RESOURCE AREAS OF THE UNITED STATES

(exclusive of Alaska and Hawaii)

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FOREWORD

This broad synthesis of our current knowledge about the soil resources of the United States is designed primarily for use in the Soil Conservation Service in developing and coordinating its soil and water conservation programs. The map itself was compiled earlier and issued in January 1963 for organizing data obtained in the national soil and water conservation needs inventory, for organizing research needs in soil and water conservation, and for correlating technical guides between States.

The supporting descriptions of the areas shown on the map are first published here. They make the map more useful for its original purposes and for suggesting additional potentialities of soil use in local areas based on research results and the experience of users elsewhere on similar soils. The map and the descriptions probably give us the best general documentation in brief form that we have had of the soil and related resources of the United States. At this stage the new States of Alaska and Hawaii, the Commonwealth of Puerto Rico, and other areas of the United States are not included.

Since this synthesis deals broadly with soils and related features so important to land use, many people in addition to those in the Soil Conservation Service may find it useful.

Any such small-scale map of a large continental area has limitations of which readers need to be aware.

First of all, new facts about soils and their responses to management and manipulation are continually being discovered.

Secondly, interpretations are based on known experience and research results under current technology. As technology changes, some interpretations become out-dated. Thus the reader must always recall that although the basic facts change little our knowledge of them, especially the interpretation of their significance to current problems and potentials of land use, does change.

Thirdly, maps on such a small scale omit many details of great local significance.

For general planning, say of a county or a local trade area, a general soil map on a scale of 1 to 4 miles to the inch is most useful. Such maps are now included in published soil surveys.

For operational planning of farms, ranches, forests, and urban-fringe communities, the map should be on a scale of 2 to 4 inches to the mile. In rural or urban areas with highly complex patterns of contrasting kinds of soil and with intensive use, working maps at 8 inches to the mile are best. For detailed designing of many highways and other construction, special maps at scales of 25 to 50 inches to the mile are used.

The detailed soil surveys made in the program of the national cooperative soil survey are currently being published in the regular series of the Department. The soil maps are mostly on controlled aerial mosaics at scales of either 3.2 or 4 inches to the mile.

Thus depending on purpose we use maps of widely varying detail. The map and descriptions in this publication are at a very high level of generalization—the map has a scale of about 160 miles per inch. We believe they can be suggestive of many ideas for solving problems and for suggesting more effective uses of land. But the map is not detailed enough for either general or operational planning of land use.

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The preparation of this publication, particularly the map, is another effort in which many employees of the Soil Conservation Service participated. They contributed a great deal of information for both the map and the descriptions. Acknowledgment for this help is made in particular to the staffs of SCS State offices and the principal correlators' offices. Darrell L. Gallup, soil scientist, assisted in preparing the descriptions.

INTRODUCTION AND DEFINITIONS

This publication and the accompanying map resulted from efforts of the Soil Conservation Service to assemble and organize currently available information about the land as a resource for farming, ranching, forestry, engineering, recreation, and other uses. The map is an updating, revision, and redesigning of the 1950 map "Problem Areas in Soil Conservation." The information provided in this handbook is current as of the end of 1964. Further revision of both map and report will be required as new information becomes available and as improved methods for organizing and presenting information are devised.

Land resource maps are interpreted primarily from general soil maps (until recently termed soil association maps); at equivalent scales, delineations on land resource maps are the same as delineations on general soil maps except that some delineations on a general soil map are divided into two or more land resource delineations because of significant and mappable differences in climate, water resources, land use, and type of farming. For example, some soil map delineations are divided into two land resource delineations on the basis of marked differences in kind of farming or climatic differences critical to one or more important crops. The principal difference between the two kinds of maps, however, is in the orientation and organization of the information and the nomenclature used to express it.

In the preparation of land resource maps at State and National levels, three land resource categories have evolved.

1. *Land resource units* are geographic areas of land, usually several thousand acres in extent, that are characterized by particular patterns of soil (including slope and erosion), climate, water resources, land use, and type of farming. A unit may occur as one continuous area or as several separate but nearby areas. Land resource units are the basic map units on State land resource maps, which are usually at the scale of 1:1,000,000. They are coextensive with map units of State general soil maps except that some map units of general soil maps are subdivided into two or more land resource units because of significant differences in climate, water resources, land use, and type of farming. They are not described in this handbook or shown on the national map, but they are the basic units from which the major land resource areas have been determined.

2. *Major land resource areas* consist of geographically associated land resource units. Identification of these large areas is most important in State-wide agricultural planning and has value in inter-State, regional, and national planning. At the scale of 1:1,000,000 a map of a State of ordinary size and complexity shows between 6 and 12 land resource areas.

3. *Land resource regions* consist of geographically associated major land resource areas; their identification is most significant for national planning.

In grouping land resource units into major land resource areas and these, in turn, into land resource regions, the objective is to preserve as much uniformity as possible in relationships significant to agriculture. Uniformity is greatest in land resource units, considerably less in major land resource areas, and very much less in land resource regions. Such losses in uniformity cannot be avoided.

On the map in the pocket of this handbook major land resource areas are designated by numbers. No. 1 is on the west coast and No. 156 on the east coast. The legend identifies each area by number and by a descriptive geographic name. A few major land resource areas consist of two or more parts separated for short distances by other land resource areas. Land resource regions are designated by capital letters, which are identified in the legend by a descriptive name.

Descriptions of the land resource regions and the 156 major land resource areas follow. The descriptions are based on information from many sources, mostly within the Soil Conservation Service. The principal other sources are given in the list of selected references. Most statements about land use are based on recent State soil and water conservation needs reports. The States in which each area occurs are listed, and the approximate area and proportionate extent of each in the United States is listed in table 1 in the appendix.

The dominant physical characteristics of each land resource region and area are described briefly under five headings: **Land Use, Elevation and Topography, Climate, Water, and Soil.** Definitions of the kinds of information included under each heading in this handbook follow.

Land Use also includes statements of principal crops and type of farming. Figures given for the proportion of cropland, pasture, range, forest, and land in industrial and urban uses are for the entire area unless specifically stated otherwise.

For **Elevation** a range in height above sea level for the area as a whole is given, followed by a brief statement of significant exceptions to the general range, which is not absolute but one that best characterizes the area. **Topography** is described in very broad terms and includes features characteristic of most of the area. Significant exceptions are mentioned.

Climate includes only three features. *Average annual precipitation* gives a range of annual averages—

from those in the driest parts of the area to those in the wettest parts. A statement of seasonal distribution of precipitation is included. For both *average annual temperature* and *average freeze-free period*, a range—again characteristic and not absolute—of annual averages in different parts of the area is given.

Water includes statements of surface streamflow and ground water. Special mention is made of sources of irrigation water and, in some areas, of municipal water. Some land resource areas depend on other areas for their water supply; some furnish water to other areas.

Soil information is given by naming the principal great soil groups [1] and soil series [2] because they connote more information than could be given in very brief soil descriptions. Names of representative soil series are given in parentheses after each great soil group. Usually enough descriptive information is given to provide a general notion of the soils to those unfamiliar with the great soil groups and soil series. The appendix includes descriptions of the great soil groups but not descriptions of soil series. Reports of modern soil surveys of counties within a major land resource area contain descriptions of soil series. Other publications, such as bulletins of some State agricultural experiment stations, also contain descriptions of soil series.

Since the material for this publication was prepared, the new comprehensive soil classification system [3] has been adopted by the Soil Conservation Service for use in the national cooperative soil survey. Table 2 (in appendix) shows the relation of the great soil groups of the modified 1938 Yearbook classification, which are described in the appendix, to great groups in the comprehensive system. It must be emphasized that no groups in the two systems are exactly equivalent.

[1] Great soil groups consist of many soil series whose profiles have many features in common. All soil series in any one great soil group have the same number and kind of major horizons, but the horizons may not be expressed to the same degree in every profile.

[2] A soil series is a group of soils that have profiles almost alike. The soils have horizons similar in order and in differentiating characteristics in the soil profile except for texture of the surface soil, and they formed in a particular kind of parent material.

[3] Soil Classification, a Comprehensive System, 7th Approximation. Soil Survey Staff, Soil Conservation Service, U.S. Dept. Agr. 265 pp. 1960.

A—NORTHWESTERN FOREST, FORAGE, AND SPECIALTY CROP REGION

68,700 square miles

Steep mountains and narrow to broad, gently sloping valleys and plains characterize this region. The annual precipitation ranges from 40 to 70 inches over much of the region, but it is 15 inches or less in some valleys and as much as 200 inches in some of the higher mountains. All parts of the region have a pronounced dry season in summer. Average annual temperatures are 50° to 55° F. over most of the region but 35° F. or less in some of the mountains. The freeze-free season is more than 200 days in most valleys, as long as 300 days along the coast in the southern part, and only 115 days in the mountains.

Reddish-Brown Lateritic soils, Yellowish-Brown Lateritic soils, Brown Forest soils, Ando soils, Sols Bruns Acides, and Lithosols are the principal soil groups in the mountains and uplands. Alluvial soils, Brunizems, Brown Podzolic soils, and Humic Gley soils are extensive in the valleys.

The mountains are heavily forested, and lumbering is a major industry. Dairy farming is important in the valleys with higher rainfall; grain crops, grass and legume seeds, fruits, and horticultural specialities are grown extensively in the drier valleys.

1—Northern Pacific Coast Range and Valleys

Washington and Oregon
7,200 square miles

Land Use: Nearly all this area is in forest, mostly privately owned; about one-sixth of the land is owned by the Federal Government. Lumbering is the principal industry. Recreation and wildlife habitat are other important uses of the forested land. About 5 percent of the total area, in narrow valleys and on narrow coastal plains, is cleared. Hay for dairy cattle is the chief crop, and some grain and improved pasture are grown.

Elevation and Topography: Sea level to 3,000 feet, some mountain peaks nearly 7,000 feet. Gently to steeply sloping hills and low mountains occupy nearly all the area. Valleys are narrow and coastal plains are discontinuous and of small total extent.

Climate: *Average annual precipitation*—35 to 125 inches (50 to 100 inches in much of the area); evenly distributed through fall, winter, and spring; summers are dry. *Average annual temperature*—45° to 55° F. *Average freeze-free period*—140 to 225 days, decreasing with elevation.

Water: Abundant rainfall and many perennial streams provide enough water for all present needs within the area. The streams also provide water for irrigation and other purposes to adjoining lower drier valleys. Glacial and alluvial deposits in the valleys yield large quantities of ground water.

Soil: *Reddish-Brown Lateritic soils* (Olympic and Melbourne) and *Sols Bruns Acides* (Astoria) on consolidated rocks and *Ando soils* (Quillayute) in areas containing a large amount of volcanic ash are the major soils. Soils used for agriculture are *Sols Bruns Acides* (Nehalem and Chehalis) in alluvium-filled valleys and *Ando soils* (Quillayute and Spanaway) on terraces and coastal plains covered by volcanic ash.

2—Willamette and Puget Sound Valleys

Washington and Oregon
26,700 square miles

Land Use: Much of the land is privately owned; about one-sixth is owned by the Federal Government. Nearly three-fourths of the land in Puget Sound Valley is forested and lumbering is a major industry. In Willamette Valley the proportion of forested land is smaller—three-fifths or less of the area—and lumbering is not so important. Less than one-fifth of the total area is in crops or improved pasture, but agriculture is highly diversified. Deciduous fruits, berries, vegetables, seed crops, and grain grown under intensive management are the major crops; hay and grain for dairy and poultry feed also occupy large acreages. High-value crops are irrigated in some places, but most of the crops depend on rainfall for water.

Elevation and Topography: Sea level to 1,500 feet. Willamette Valley consists of nearly level to gently sloping flood plains bordered by dissected higher terraces. Glacial till, glacial outwash, and lacustrine deposits cover Puget Sound Valley.

Climate: *Average annual precipitation*—15 to 60 inches (30 to 45 inches in much of the area); evenly distributed through fall, winter, and spring; summers are dry. *Average annual temperature*—48° to 55° F. *Average freeze-free period*—180 to 240 days.

Water: Moderate rainfall and abundant streamflow provide enough water for present needs. Additional supplies are available from adjoining mountain ranges if needed. Ground water is plentiful in glacial and alluvial deposits.

Soil: *Gray-Brown Podzolic soils* (Willamette), *Planosols* (Dayton), *Sols Bruns Acides* (Chehalis), *Alluvial soils* (Puyallup), *Humic Gley soils* (Coveland, Bellingham, and Wapato), *Reddish-Brown Lateritic soils* (Olympic), and *Yellowish-Brown Lateritic soils* (Salkum) are the principal groups. *Brown Podzolic soils* (Alderwood, Bow, and Everett) are extensive in Puget Sound Valley.

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3—Olympic and Cascade Mountains (Western Slope)

Washington and Oregon
18,400 square miles

Land Use: More than three-fifths of the area is owned by Federal and State Governments. Most of the area is densely forested, and lumbering is the major industry. Mining is important in some places; recreation and wildlife habitat are other important uses. Some of the alpine meadows at the highest elevations provide summer range. About 5 percent of the area, mainly in the upper reaches of the major stream valleys, is cultivated. Forage and feed grains are the principal crops.

Elevation and Topography: 1,000 to 8,000 feet, some mountain peaks 14,000 feet. Steep to precipitous mountains, narrow valleys, and narrow divides are dominant. There are some small plateaus, and narrow bands of bottom land and terraces border some of the streams.

Climate: *Average annual precipitation*—50 to 90 inches in most of area, 30 inches in some valleys, and 200 inches on eastern slopes of mountains; increases with elevation and from south to north; falls mostly in fall, winter, and spring and much of it is snow. *Average annual temperature*—35° to 50° F., decreasing with elevation. *Average freeze-free period*—100 to 200 days, decreasing with elevation; frost every month of the year on some high mountain peaks.

Water: Rainfall and perennial streams provide abundant water for all present needs within the area. This area also supplies water to adjoining lower and drier areas.

Soil: Detailed information is lacking for most of the area. *Reddish-Brown Lateritic soils* (Olympic), *Brown Podzolic soils* (Cathcart and Oso), *Podzols* (Marblemount, Klaus, and Tokul), *Sols Bruns Acides*, *Alpine Meadow soils*, and *Lithosols* are the principal great soil groups. *Alluvial soils* (Puyallup, Pilchuck, and Wickersham) occur in small areas on flood plains of the larger streams.

4—California Coastal Redwood Belt

California
4,200 square miles

Land Use: Most of the land is in privately owned farms, ranches, or forest; about 10 percent is owned by the Federal Government. A large part of the area is densely forested with redwood, Douglas-fir, and associated species, and lumbering is the major industry. About 10 percent is grassland used for grazing. Cultivated land in valleys, less than 5 percent of the total area, is used mainly for forage and grain for dairy cattle; vegetables are grown where soils and climate are favorable.

Elevation and Topography: Sea level to 2,500 feet, some peaks 4,000 feet. Low but steeply sloping mountains are dominant. Gently sloping marine terraces border the coast, and a few broad valleys extend inland through the mountains.

Climate: *Average annual precipitation*—32 to 80 inches; evenly distributed through fall, winter, and spring but very low in summer; heavy fogs are common along the coast in summer. *Average annual temperature*—50° to 55° F. *Average freeze-free period*—250 to 300 days.

Water: Abundant rainfall and many perennial streams provide enough water for most requirements. The drier valleys depend on streamflow from the mountains. Ground water is abundant in the deeper valley-fill deposits.

Soil: Detailed information is lacking. *Red-Yellow Podzolic soils*, *Reddish-Brown Lateritic soils*, and *Yellowish-Brown Lateritic soils* are dominant on forested mountain slopes and *Brunizems* on grassed areas at lower elevations.

5—Siskiyou-Trinity Area

Oregon and California
12,200 square miles

Land Use: Nearly half of the area is owned by the Federal Government. Most of the Federal land as well as the privately owned land is in forests of Douglas-fir, ponderosa pine, and sugar pine. Lumbering is important in these forests, which also provide wildlife habitat and recreation. About 5 percent of the area is grazed and a smaller amount is cropped. Truck crops are important in valleys that have enough water. On the more sloping parts of the valleys, small grains, hay, and pasture are grown to feed dairy cattle and other livestock.

Elevation and Topography: 300 to 4,500 feet, some mountain peaks 7,000 feet. Rounded but steeply sloping mountains that are underlain mainly by sandstone and shale but in some places by granodiorite, gabbro, and other intrusive rocks are dominant. The narrow valleys have gently sloping flood plains and alluvial fans and are bordered by more strongly sloping foothills.

Climate: *Average annual precipitation*—18 inches in some valleys to 70 inches in the mountains; very low in summer and evenly distributed through rest of year. *Average annual temperature*—45° to 55° F. *Average freeze-free period*—115 to 250 days, decreasing with elevation.

Water: The moderate to high rainfall provides enough water in the mountains and higher valleys and, through streamflow, supplies irrigation water to the drier valleys. Ground water is abundant in alluvial deposits in most valleys.

Soil: Detailed information is lacking for much of the area. *Reddish-Brown Lateritic soils* and *Yellowish-Brown Lateritic soils* (Masterson and Neuns) are the principal soils on the mountains and *Alluvial soils* (Cortina) on the lower alluvial fans and flood plains.

B—NORTHWESTERN WHEAT AND RANGE REGION

97,600 square miles

A few mountain ranges are included in this region of smooth to deeply dissected plains and plateaus. The annual precipitation ranges from 10 to 23 inches over much of the area; in some valleys it is as low as 6 inches and in some mountains as much as 60 inches or more. Summers are dry. Average annual temperatures are 45° to 50° F. in most of the area but range from 38° to 55° F. The freeze-free season ranges from 120 to 200 days except in the mountains where it is shorter.

Brown soils, Chestnut soils, Sierozems, Chernozems, and Brunizems, all derived mainly from loess, are dominant over much of the region. Ando soils are conspicuous in places where the parent materials consist mostly of volcanic ash. Lithosols occur on the steep slopes underlain by basalt and lava. Alluvial soils on flood plains are important for agriculture.

Wheat grown by dryfarming methods is the major crop over most of the region, but oats and peas are important also. Fruit, mainly apples, is a major crop in the west. Potatoes, sugar beets, beans, and forage crops are grown on the irrigated land along Snake River in the eastern part of the region. Grazing is the major land use in the drier parts, especially in the west.

6—Cascade Mountains (Eastern Slope)

Oregon and Washington
17,200 square miles

Land Use: About three-fifths of the area is owned by the Federal Government; most of the remainder is in farms, ranches, or privately owned woodlands. Much of the land, probably more than three-fourths, is in forest. Douglas-fir, larch, ponderosa pine, and lodgepole pine grow on the upper slopes where moisture is plentiful. Lumbering is important in these forests, which also serve as wildlife habitat and for recreation. Parklike woodlands at the lower elevations have an understory of grass, sagebrush, and bitterbrush and are used for grazing. About 5 percent of the area, mostly in valleys, is cropland, most of which is irrigated. Fruit, mainly pears, is a major crop along the Hood River; grain and forage crops are most extensive elsewhere. Small areas are dryfarmed to wheat.

Elevation and Topography: Mostly 1,000 to 4,500 feet, mountain crests in Washington 10,000 feet. Strongly sloping mountains that have some gently sloping crests and benches are dissected by many streams.

Climate: *Average annual precipitation*—12 to 30 inches in the lower valleys and foot slopes and 60 inches or more on the mountain crests; snowfall is heavy. *Average annual temperature*—45° to 52° F. *Average freeze-free period*—60 to 140 days, decreasing with elevation.

Water: The low to moderate rainfall and moderate streamflow are the principal sources of surface water. Ground-water supplies in the lavas that underlie most of the area are small and largely untapped.

Soil: Soils vary widely. *Podzols* (Pend Oreille, Methow, Cle Elum) and *Brown Podzolic soils* (Waits) are extensive at higher elevations where moisture is plentiful, *Lithosols* on most of the steeper mountain slopes, *Chestnut soils* (Cherryhill) at lower elevations, *Regosols* in pumice and glacial till, and *Alluvial soils* in valleys.

7—Columbia Basin

Washington and Oregon
9,200 square miles

Land Use: Most of the area is in ranches, farms, and other private holdings; about one-fifth is owned by the Federal Government. About three-fifths of the area is in range of native grasses and shrubs and is grazed by cattle and sheep. About 10 percent of the area is irrigated and used for intensive production of fruits, vegetables, grain, hay, and pasture. An additional one-fourth of the area, the parts having deep silty soils but lacking water for irrigation, is dryfarmed; wheat is the principal crop.

Elevation and Topography: Mostly 1,000 to 1,500 feet, some deep canyons 350 feet, and some ridges 3,500 feet. The basin is a gently sloping to rolling plain broken by some steep ridges and steep-walled valleys.

Climate: *Average annual precipitation*—6 to 14 inches; highest in winter. *Average annual temperature*—47° to 55° F. *Average freeze-free period*—120 to 200 days.

Water: The Columbia, Yakima, and Snake Rivers supply large amounts of water for irrigation in their valleys but water is scarce elsewhere. Ground-water supplies in lavas underlying much of the area are small and largely untapped.

Soil: *Sierozems* (Ephrata, Warden, Sagemoor, and Timmerman) derived from glacial drift, loess, volcanic ash, or a mixture of these materials are the principal soils. Basalt rockland and rock outcrop occupy the steep ridges, scablands, and canyon walls. *Alluvial soils* (Esquatzel and Yakima) and *Humic Gley soils* (Kittitas) on flood plains and *Regosols* (Quincy) on sandy terraces are other important soils.

8—Columbia Plateau

Washington and Oregon
14,400 square miles

Land Use: More than 90 percent of the area is in farms or ranches, about 7 percent is owned by the Federal Government, and the remainder is urban. Nearly one-half of the land is cropland, most of which is dryfarmed. The main crops are wheat and peas, but a little land is in hay and improved pasture. Some small areas along the major streams are irrigated and used for growing vegetables, fruits (mainly apples), and hay. Nearly all the remaining land, about two-fifths of the total area, is in range but small areas are wooded.

Elevation and Topography: 1,300 to 3,500 feet. These loess- and ash-mantled plateaus are nearly level to steeply sloping. Steep slopes are common along the walls of major valleys and in scablands.

Climate: *Average annual precipitation*—9 to 18 inches; highest in winter. *Average annual temperature*—45° to 55° F. *Average freeze-free period*—140 to 175 days.

Water: The low to moderate rainfall limits the choice of agricultural enterprise. The major rivers provide water for irrigation along their courses, but the few smaller streams provide little water. Ground-water supplies in the underlying basalts and lavas are small and mostly untapped.

Soil: Deep silty soils formed mostly in loess that contains small amounts of volcanic ash are dominant—*Chestnut soils* (Walla Walla and Condon) and *Brown soils* (Ritzville). *Alluvial soils* (Hermiston, Esquatzel, and Onyx) are important along the larger flood plains. *Lithosols*, shallow *Chestnut soils* (Kuhl), and shallow *Brown soils* (Bakeoven) occupy the steep slopes of scablands and canyons.

9—Palouse and Nez Perce Prairies

Washington, Oregon, and Idaho
9,200 square miles

Land Use: About one-third of the area is owned by the Federal Government; nearly all the remainder is in farms and ranches. Much of the publicly owned land and about one-fourth of the land in ranches, consisting of the drier and more sloping uplands, is in range. About two-fifths of the area is cropland, nearly all dryfarmed to wheat and peas. Irrigated land, amounting to about 1 percent of the total area, is used to grow vegetables, seeds, and other specialty crops. Small wooded areas on steep slopes amount to about 10 percent of the area.

Elevation and Topography: 600 feet along the major streams and 2,000 to 4,000 feet over most of the plain. This loess-covered basalt plain is moderately to strongly dissected; slopes are mostly hilly and steep. The major streams have cut deep canyons.

Climate: *Average annual precipitation*—18 to 23 inches; evenly distributed through fall, winter, and spring but low in summer. *Average annual temperature*—45° to 55° F. *Average freeze-free period*—120 to 170 days.

Water: Rainfall is adequate for dryfarming in most of the area. Irrigation is limited mainly to areas adjacent to the large streams. Ground-water supplies are small and mostly untapped.

Soil: The better agricultural soils formed mainly in loess containing a small amount of volcanic ash. *Brunizems* (Palouse, Gwin, Waha, and Snow) and *Planosols* (Nez Perce) are dominant. *Chernozems* (Athena and Staley) are extensive in the drier areas, *Alluvial soils* and *Humic Gley soils* (Caldwell) in valleys, and scablands on lava flows.

10—Upper Snake River Lava Plains and Hills

Idaho, Utah, and Oregon
17,700 square miles

Land Use: Nearly three-fifths of the area is owned by the Federal Government; most of the remainder is in farms or ranches. About three-fourths of the land is in grass and sagebrush used for range. The highest mountain slopes, about one-fifth of the area, are in forests of pine, spruce, and fir. Lumbering is important in these forests, which serve also as wildlife habitat and for recreation. About 5 percent of the total area, land bordering the large streams, is irrigated and used to grow potatoes and small grains and for pasture. Where rainfall is adequate, small areas of deep soils are dryfarmed.

Elevation and Topography: 1,300 to 6,500 feet, increasing from west to east, some mountain peaks 8,500 feet. The lava plains and hills are nearly level to steeply sloping. There are deep alluvial deposits in valleys and on fans adjacent to the mountains. The major streams are deeply entrenched, especially in the western part. Isolated mountain ranges occur throughout the area.

Climate: *Average annual precipitation*—10 to 20 inches; evenly distributed through fall, winter, and spring but low in summer. *Average annual temperature*—40° to 55° F. *Average freeze-free period*—60 to 165 days, decreasing from west to east and with elevation.

Water: The low to moderate rainfall is adequate for dryfarming on the smoother areas of deeper soils. Streams provide irrigation water for present needs along the major valleys. Ground-water supplies are small and at present mostly untapped.

Soil: *Chestnut soils* (Gem and Newell) and *Brown soils* (Lookout, Deschutes, and Madras) formed in alluvium, older unconsolidated deposits, and in some places thin loess are dominant. *Lithosols*, shallow *Brown soils* (Bakeoven and Ruckles) and *Regosols* are extensive on the steeper slopes, *Chernozems* and *Brunizems* on high mountain slopes, and soils transitional between *Brunizems* and *Gray-Brown Podzolic soils* on mountain tops and north-facing slopes.

11—Snake River Plains

Idaho and Oregon
16,200 square miles

Land Use: Nearly one-half of the land is owned by the Federal Government; the remainder is in farms

and ranches. Bare lava flows in the east include Craters of the Moon National Monument. About one-fourth of the area, the lower plains bordering Snake River, is irrigated. Potatoes, grain, sugar beets, beans, and hay are the principal crops, and there is some irrigated pasture. Other small areas that have favorable soils and moisture supplies are dryfarmed. Most of the Federally owned land and about one-fourth of the privately owned land is in range of sparse sagebrush and grass that has a low carrying capacity.

Elevation and Topography: 2,000 to 5,500 feet. These nearly level to steeply sloping lava plains have a thin to moderately thick cover of loess. Alluvial fans, terraces, and bottom lands are gently to moderately sloping.

Climate: *Average annual precipitation*—7 to 13 inches; little or none in summer. *Average annual temperature*—41° to 52° F. *Average freeze-free period*—90 to 170 days.

Water: A large amount of water is available for irrigation along Snake River and its larger tributaries. Ground water is plentiful in some of the deeper alluvial deposits throughout the area and in the lavas north of Snake River in eastern and central Idaho and has been used extensively for irrigation. In areas far from the major rivers, which depend on local rainfall, water is scarce.

Soil: *Calcisols* (Portneuf and Declo) and *Brown soils* (Paul) are dominant on the lower loess-capped lava plains and the alluvial fans and *Sierozems* with caliche (Minidoka) on the loess-capped older lava flows. *Alluvial soils* (Moulton) are important on the lower younger fans and flood plains. Recent lava flows and rockland are extensive in the east.

12—Lost River Valleys and Mountains

Idaho
7,200 square miles

Land Use: Nearly all the area is owned by the Federal Government. The higher mountain slopes are forested and some lumber is produced. The lower grass- and shrub-covered slopes and valleys are grazed. Irrigated land in the valleys, amounting to about 1 percent of the area, is used mostly for hay and pasture, but potatoes and small grains are grown also.

Elevation and Topography: 4,500 feet in the valleys to more than 10,000 feet at the highest mountain crests. Steep to very steep mountains underlain by mixed sedimentary rocks and volcanic rocks constitute more than 80 percent of the area. The large valleys deeply mantled by recent alluvium and some lacustrine deposits are level to moderately sloping.

Climate: *Average annual precipitation*—7 to 11 inches in valleys, increasing to 25 inches or more on mountain crests. *Average annual temperature*—38° to 45° F. in the valleys but much lower in the mountains. *Average freeze-free period*—80 to 110 days in the valleys; frosts occur every month of the year in the higher mountains.

Water: The moderate rainfall provides enough moisture for grass and shrubs to grow on mountain slopes, but valleys depend on streamflow from higher areas for water for livestock and irrigation. Springs and shallow wells in the valleys supply a small amount of ground water.

Soil: Detailed information is lacking for much of the area. *Lithosols* are the principal soils on mountain slopes. In valleys, *Desert soils, Brown soils, Sierozems, Calcisols,* and *Regosols* occupy the gently to strongly sloping fans and *Alluvial soils, Humic Gley soils,* and *Solonchak soils* the flood plains and lacustrine deposits. Some of the soils in valleys contain small to moderate amounts of alkali or salts.

13—Eastern Idaho Plateaus

Idaho
6,500 square miles

Land Use: Nearly three-fourths of the land is in farms and ranches; the remainder is owned by the Federal Government. About one-fourth of the area is dryfarmed; wheat is the major crop. An additional 10 percent, land along some of the large streams, is irrigated and used largely for hay meadows and pasture, but some small grains and potatoes are grown. Much of the remaining land, amounting to about one-half of the area, is in range. About 10 percent, consisting of the higher mountain slopes, is in forests, which produce some timber and are grazed.

Elevation and Topography: 4,500 to 6,500 feet in plains and plateaus, mountain crests mostly 7,500 to 8,500 feet but some peaks more than 10,000 feet. The dissected plateaus and plains are underlain by sedimentary rocks that are mantled by loess on the gentle slopes. Lacustrine deposits and deep alluvium fill some level valleys and basins. The plains and plateaus are separated by many rugged but discontinuous mountain ranges and peaks.

Climate: *Average annual precipitation*—12 to 20 inches; lowest from midsummer through autumn. *Average annual temperature*—40° to 45° F. but lower in mountains. *Average freeze-free period*—50 to 120 days; frosts occur every month of the year in the higher mountains.

Water: The scarcity of water imposes serious limits on agriculture. Rainfall provides water for dryfarming and grazing, but careful management is needed to make the best use of the limited amount. Perennial streams are few, and very little water is available for irrigation. Ground water is also scarce.

Soil: *Chestnut soils* from loess and residual materials are the principal soils in about two-thirds of the area. *Chernozems* (Lanark) on the higher slopes and in some of the moister loess-mantled areas and *Brown soils* in the drier areas are the principal soils in the remainder. *Lithosols* occupy the steeper slopes underlain by hard bedrock and *Regosols* the steep slopes of unconsolidated materials.

C—CALIFORNIA SUBTROPICAL FRUIT, TRUCK, AND SPECIALTY CROP REGION

66,100 square miles

This region of low mountains and broad valleys has a long warm growing season and low precipitation. The annual rainfall ranges from 40 inches to less than 10 inches; very little occurs from late April through October. Average annual temperatures are 60° to 65° F. over most of the region but are as low as 32° F. at some of the higher elevations. The average freeze-free season is 230 to 270 days in much of the region but is 125 days or less in some of the higher mountains and more than 350 days in the valleys of the south.

Noncalcic Brown soils, Grumusols, and Brunizems are extensive on the uplands and older terraces throughout the region, but Alluvial soils and Humic Gley soils on flood plains and alluvial fans are the most important soils for agriculture. Many of the soils on flood plains and low terraces are affected by salts and must be skillfully managed for satisfactory crop yields.

This region has a wide variety of crops and agricultural enterprises. Citrus fruits, other subtropical and tropical fruits, and nuts are major crops in the southern half. Many kinds of vegetables, grown mainly under irrigation, are produced throughout the region. Rice, sugar beets, cotton, grain crops, and hay are also important. Dairying is a major enterprise near the large cities. Beef-cattle production on feed lots and range is also important.

14—Central California Valleys

California
5,200 square miles

Land Use: Most of the land is in farms and ranches; about 10 percent is urban and the amount in this use is increasing rapidly. The gently sloping land in the valleys is intensively farmed and many kinds of crops are grown. Truck crops, subtropical fruits, nuts, small grains, hay, and pasture are the principal crops on irrigated land and small grains on dryfarmed areas. Dairy and poultry farming are important near the large cities. The more sloping fans and foothills, amounting to one-fourth or more of the area, are in native range used for livestock grazing. A few small areas on the steep slopes along the coast remain in redwood forest.

Elevation and Topography: Sea level to 2,000 feet but less than 1,000 feet in most of the area. This area is a network of gently sloping valley floors bordered by higher and more sloping terraces and fans and by steep uplands.

Climate: *Average annual precipitation*—12 to 30 inches; very dry from midspring to midautumn. *Average annual temperature*—55° to 62° F. *Average freeze-free period*—250 to 365 days, longest along the coast.

Water: The low to moderate rainfall and local streamflow are inadequate for present water needs. Water from adjoining areas is brought in for both agriculture and the domestic and industrial requirements of the many large cities. The yield of ground water in the deeper alluvial deposits, especially in Santa Clara Valley, is declining, and the intrusion of sea water is reducing the quality.

Soil: *Noncalcic Brown soils* (Pleasanton, Chualar, and Zamora) on fans and terraces, *Grumusols* (Clear Lake) in fine-textured sediments and *Brunizems* (Elkhorn and Lockwood) in coarse-textured materials are extensive. *Humic Gley soils* (Alviso) and *Solonchak soils* occupy the wet parts of flood plains and *Alluvial soils* (Metz and Mocho) the better drained parts.

15—Central California Coast Range

California
15,900 square miles

Land Use: More than four-fifths of the area is in farms and ranches; most of the remainder is owned by the Federal Government. About one-fifth of the area is dryfarmed to grain, and slightly more than one-fourth is in range of native grasses and brush. Open woodland, also used for grazing, covers nearly two-fifths of the area.

Elevation and Topography: Sea level to 2,500 feet in most of the area, some mountains 5,000 feet. Gently to steeply sloping low mountains that are underlain mostly by shale and sandstone and partly by igneous and volcanic rocks cover most of the area. Coastal plains are narrow and discontinuous, and stream valleys are narrow and widely separated.

Climate: *Average annual precipitation*—12 to 40 inches (15 to 30 inches in most of the area); evenly distributed through fall, winter, and spring and very low in summer; coastal areas receive some moisture from fog in summer. *Average annual temperature*—55° to 65° F. *Average freeze-free period*—200 to 270 days.

Water: The low to moderate rainfall and only moderate streamflow limit agriculture in most of the area to dryfarming. Ground-water supplies are small.

Soil: *Grumusols* (Altamont and Diablo) in clayey materials and *Noncalcic Brown soils* (Vallecitos, Newville, and Millsap) in coarser and more acid materials on the uplands are the major soils. Others are *Brunizems* (Los Osos and Santa Lucia) on some of the

shale hills and *Alluvial soils* (Yolo) in coarse materials on flood plains of the narrow stream valleys.

16—California Delta

California
700 square miles

Land Use: Nearly all this area is farmed. Important crops are asparagus, sugar beets, potatoes, corn, and grain and hay grown under intensive management. Fruit trees, mainly pear, are grown on slopes of the protecting levee system.

Elevation and Topography: 15 feet below sea level to 10 feet above. Many streams divide this nearly level delta into islands. Dikes are required to protect much of the area against flooding.

Climate: *Average annual precipitation*—13 to 15 inches; summers are dry. *Average annual temperature*—About 60° F. *Average freeze-free period*—About 275 days.

Water: Water for agriculture comes mostly from the many streams that cross the area. Salinity is a problem in water management.

Soils: The major soils are *Bog soils* (Staten, Venice, and Egbert) in peat and muck deposits and *Humic Gley soils* (Ryde) in wet alluvial deposits.

17—Sacramento and San Joaquin Valleys

California
18,200 square miles

Land Use: More than 90 percent of the land is in farms and ranches. Much of the remainder is owned by the Federal Government, but 2 or 3 percent is urban and the amount of land in this use is increasing rapidly. Slightly more than half the area is cropland of which three-fourths or more is irrigated. Cotton, fruits, nuts, grapes, hay, grain, and pasture are grown on the irrigated land. The more sloping unirrigated cropland is dryfarmed to grain. About a third of the area is in native grasses, brush, and open woodland and is used mostly for range.

Elevation and Topography: Sea level to 500 feet. Broad smooth nearly level valleys are bordered by more sloping alluvial fans and slightly dissected terraces. There are large basins in the south.

Climate: *Average annual precipitation*—5 to 25 inches; long dry period in summer. *Average annual temperature*—60° to 67° F. in most of area but as low as 55° F. in the north. *Average freeze-free period*—230 to 350 days, increasing from north to south.

Water: The low rainfall and relatively small streamflow result in a scarcity of water in many parts of the area. The more intensively farmed irrigated areas depend on water from the adjoining mountains. In the south much of the irrigation water comes from wells, but supplies are diminishing because of the lowered water table.

Soil: *Noncalcic Brown soils* (San Joaquin, Madera, Arbuckle, and Redding) occupy large areas on alluvial fans and older terraces and *Solonetz soils* with hardpans (Fresno) similar positions in the drier parts of the area. *Alluvial soils* (Hanford, Panoche, and Yolo) and *Humic Gley soils* (Merced and Sacramento) are major soils on flood plains. *Regosols* (Delhi) are extensive in deep sands in some of the drier parts.

18—Sierra Nevada Foothills

California
9,200 square miles

Land Use: About four-fifths of the area is in farms and ranches; most of the remainder is owned by the Federal Government. Much of the area is in native and tame grasses and a sparse to thick cover of shrubs, but there are some open forests at higher elevations. Production of livestock on range is the principal enterprise of the area. Irrigated cropland in the valleys used for growing fruits, nuts, and grain makes up between 5 and 10 percent of the area.

Elevation and Topography: 500 to 2,500 feet, some mountain peaks 4,000 feet. In this area of rolling to steep dissected hills and low mountains, the stream valleys are narrow and have fairly steep gradients.

Climate: *Average annual precipitation*—12 to 40 inches; summers are dry. *Average annual temperature*—55° to 65° F. *Average freeze-free period*—135 to 320 days.

Water: The moderate rainfall and intermittent streamflow are the major water sources. Ground-water supplies are small and mostly untapped.

Soil: *Noncalcic Brown soils* (Auburn and Sierra) are dominant. *Lithosols* (Exchequer and Toomes) are common on the more sloping areas.

19—Southern California Coastal Plain

California
7,200 square miles

Land Use: More than one-fourth of the land is owned by the Federal Government; about one-fifth is urban or in built-up areas and additional land is being converted to this use very rapidly. One-third or more of the area is brushland that serves primarily as watershed protection. Fire prevention on this land is a major problem. Irrigated cropland, amounting to 10 to 20 percent of the area, is used to grow tropical fruits, deciduous fruits, grain, truck crops, grapes, hay, and pasture. Dairy farming and flower-seed production are other important enterprises. Some livestock are produced on range in areas far from the large cities.

Elevation and Topography: Sea level to 2,000 feet. These gently to strongly sloping and dissected coastal plains are bordered by steeply sloping hills.

Climate: *Average annual precipitation*—10 to 25 inches; summers are dry although fogs provide some moisture along the coast. *Average annual temperature*—60° to 65° F. *Average freeze-free period*—365 days along the coast, decreasing to 250 days in the hills.

Water: The low rainfall and intermittent streamflow provide only small local supplies. Ground-water resources have been heavily exploited, and declining water tables and salt intrusion are reducing both quantity and quality. Much of the water for irrigation and nearly all the water for large urban areas is brought in from the Colorado River.

Soil: *Noncalcic Brown soils* (Ramona, Rincon, Fallbrook, and Vista) on terraces and on rolling hills underlain by granitic materials and *Grumusols* (Altamont) in fine-textured materials are the principal soils. *Noncalcic Brown soils* with claypans (Milpitas and Olivenhain) occupy the coastal terraces and *Alluvial soils* (Hanford) the flood plains.

20—Southern California Mountains

California
9,700 square miles

Land Use: More than two-fifths of the area is owned by the Federal Government, about 5 percent is urban, and the remainder is in farms, ranches, or other private holdings. About half the area has a brush cover that serves as watershed protection. Fire prevention is a serious problem in these areas. Open woodland and brushland having a grass understory and grazed amount to about one-fifth of the total area. Most of the larger valleys are dryfarmed to grain and hay, but locally fruits are grown under irrigation.

Elevation and Topography: 2,000 to 8,000 feet over most of the area, some peaks 12,000 feet, and a narrow strip along the western edge at sea level. These strongly sloping to precipitous mountains have unstable slopes and sharp crests; valleys are narrow.

Climate: *Average annual precipitation*—16 to 40 inches; summers are dry; a little snow falls in winter but does not last. *Average annual temperature*—32° to 60° F., decreasing with elevation. *Average freeze-free period*—100 to 200 days in most of the area, decreasing with elevation, and as long as 250 days along the western edge.

Water: The moderate rainfall provides water for brushland and range and also meets part of the water needs of adjacent lower areas. Deep sand and gravel deposits in the valleys yield water for livestock and domestic use and for some irrigation.

Soil: Most of the soils are shallow. *Reddish-Brown Lateritic soils* that have a dark surface layer (Holland) are extensive on crystalline rocks, *Brunizems* in areas of intermediate rainfall, and *Noncalcic Brown soils* (Las Posas and Vista) in the moderately dry areas.

D—WESTERN RANGE AND IRRIGATED REGION

545,200 square miles

This is a semidesert to desert region of plateaus, plains, basins, and many isolated mountain ranges. The annual precipitation is 10 inches or less over most of the plains and basins but more than 50 inches on some of the higher mountains. In the southeast most of the rain falls in the warm season, but elsewhere precipitation is higher in the cool season. Average annual temperatures in most of the region are 45° to 55° F., but they range from 35° F. at the higher elevations in the north to more than 70° F. in some of the lowlands in the south. The freeze-free season ranges from less than 90 days in the north and in some of the higher mountains to more than 240 days in the south.

Sierozems, Desert soils, Brown soils, and Grumusols are extensive on the plains and plateaus and in valleys throughout the region. Chestnut soils, Chernozems, and Gray Wooded soils occur on some of the mountain slopes. Alluvial soils, Solonetz soils, and Solonchak soils on the plains and in basins and Lithosols on the mountain slopes are also important.

Much of the land in this region is used for range, but irrigation agriculture is practiced where water is available and soils are favorable. Feed crops for livestock occupy much of the irrigated land, and peas, beans, and sugar beets are grown in many places. Cotton and citrus fruits are important in southwestern Arizona.

21—Klamath and Shasta Valleys and Basins

California and Oregon
14,700 square miles

Land Use: About one-half of the area is owned by the Federal Government; the remainder is in farms and ranches. Between 5 and 10 percent of the land is irrigated and used to grow potatoes, grain, seed crops, and hay and for pasture. An additional 1 or 2 percent is dryfarmed to grain. Most of the remaining land, both privately and publicly owned, is in grass or open woodland used for grazing. Forests of ponderosa pine, Douglas-fir, and fir on the upper mountain slopes produce some lumber.

Elevation and Topography: 2,500 to 4,500 feet, some mountain peaks 6,000 feet or more. Lava plateaus and many valleys and basins make up most of the area. Steep mountain spurs and rim-rock escarpments surround the plateaus.

Climate: *Average annual precipitation*—12 to 20 inches in most of area but as much as 30 inches at higher elevations; summers are dry. *Average annual temperature*—45° to 52° F. *Average freeze-free period*—70 to 140 days, decreasing with elevation.

Water: The low rainfall and the consequent erratic flow of local streams limit the supply of water for agriculture. Ground water is scarce in the dense lava rocks that underlie much of the area. In areas underlain by more porous rocks, ground-water supplies are large but mostly untapped.

Soil: *Chestnut soils* (Bieber) on terraces and fans and *Grumusols* (Lassen and Montague) on uplands and in basins are the most extensive soils. Also important are *Alluvial soils* on flood plains in the valleys and *Brown Forest soils* on the more humid higher mountain slopes in Oregon.

22—Sierra Nevada Range

California
22,200 square miles

Land Use: More than one-half of the land is owned by the Federal Government; Yosemite and Sequoia National Parks are in this area. The remainder is in privately owned forests, farms, and ranches. About 90 percent of the land is in forests of ponderosa pine, sugar pine, lodgepole pine, Douglas-fir, white fir, and Jeffrey pine. These forests are used mostly for recreation and as wildlife habitat, but lumbering is an important enterprise in those privately owned. Open woodland and grassland, mostly above the timberline, provide some summer grazing. Some of the valleys, amounting to 1 or 2 percent of the total area, are used for growing hay and grain for livestock.

Elevation and Topography: 2,000 to 8,000 feet, some mountain peaks 14,500 feet. Most of the area consists of strongly sloping to precipitous mountains crossed by many valleys having steep gradients. Some plateau remnants and mesas are included.

Climate: *Average annual precipitation*—40 to 60 inches over much of the area, as low as 15 inches in the lower valleys and foothills, and as much as 70 inches on the mountain peaks; precipitation increases from south to north; summers are dry, and much of the winter precipitation is snow. *Average annual temperature*—35° to 52° F., decreasing with elevation. *Average freeze-free period*—30 to 180 days, decreasing with elevation.

Water: The abundant rainfall and snowfields on the higher mountain slopes supply water to many large perennial streams. Much of this water is used in adjoining valleys.

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Soil: Detailed information is lacking for much of this area. *Reddish-Brown Lateritic soils* (Aiken, Sites, and Holland) and *Red-Yellow Podzolic soils* (Mariposa) are extensive on the humid mountain slopes. *Ando soils* (Windy) are in tuff, *Regosols* in granitic materials, and *Lithosols* (Iron Mountain and Tollhouse) on the steeper slopes. *Brunizems* (Childs) and *Alluvial soils* occupy narrow flood plains and alluvial fans in the valleys.

23—Malheur High Plateau

Nevada, Oregon, and California
28,300 square miles

Land Use: About three-fourths of the area is owned by the Federal Government. Livestock production on range is the principal agricultural activity. Grain and hay for winter feed and pasture are grown in the 1 or 2 percent of the area that is irrigated. Small areas on the upper mountain slopes are in forests of Jeffrey pine and fir.

Elevation and Topography: 4,500 to 7,000 feet, some mountains more than 9,000 feet. Nearly level basins and valleys are bordered by long gently sloping alluvial fans. North-south-trending mountain ranges and a few volcanic plateaus rise sharply above the valleys.

Climate: *Average annual precipitation*—8 to 14 inches in most of the area but as much as 20 inches on some of the higher mountain slopes; fairly evenly distributed through fall, winter, and spring but low in summer. *Average annual temperature*—41° to 50° F. *Average freeze-free period*—60 to 140 days, decreasing with elevation.

Water: Water is scarce except at higher elevations where rainfall is higher. Streamflow is erratic and depends mostly on runoff from melting snow. The large ground-water supplies in the gravel- and sand-filled valleys are mostly untapped.

Soil: Detailed information is lacking for much of the area. The major soils are *Sierozems* and *Brown soils* on older alluvial fans and terraces; *Grumusols*, *Humic Gley soils*, and *Solonetz soils* in dry lake basins and younger alluvial deposits; and *Regosols* and *Chestnut soils* (Simpson) on most mountain slopes.

24—Humboldt Area

Nevada
10,700 square miles

Land Use: About four-fifths of the land is owned by the Federal Government; the remainder is in farms and ranches. Livestock grazing on native range of grasses, sagebrush, shadscale, greasewood, and other shrubs is the principal agricultural enterprise. Less than 2 percent of the area, narrow strips along the major streams, is irrigated and used to grow hay and grain for winter livestock feed and tame pasture.

Elevation and Topography: 4,000 to 6,000 feet, some mountain peaks more than 9,000 feet. The eastern half is a nearly level plain covered by lacustrine materials. In the western half north-south-trending mountain ranges are separated by nearly level broad valleys filled with alluvium and some lacustrine materials.

Climate: *Average annual precipitation*—6 to 12 inches in most of the area but as much as 20 inches on some mountain slopes; summers are dry. *Average annual temperature*—40° to 50° F. *Average freeze-free period*—60 to 130 days, decreasing with elevation.

Water: The low rainfall and intermittent streamflow provide only a small amount of water. Ground water is abundant in the deep valley fills but has been little used.

Soil: *Sierozems* are the most extensive soils but *Solonetz soils* and *Solonchak soils* are also widespread in the basins. *Alluvial soils* and *Humic Gley soils* (Humboldt) occupy relatively narrow bands on stream flood plains and the younger lower alluvial fans and *Lithosols* the steep slopes of dissected fans and the steeper mountain sides.

25—Owyhee High Plateau

Nevada, Oregon, and Idaho
24,700 square miles

Land Use: About three-fourths of the area is owned by the Federal Government; most of the remainder is in farms and ranches. Native grasses and sagebrush cover much of the area, and livestock production on range is the principal agricultural activity. Valley lands, amounting to 2 or 3 percent of the total area, are irrigated and used for growing grain and forage for livestock. Small areas in Idaho are dry-farmed to grain. Open forests of Jeffrey pine and some fir on the high mountain slopes supply lumber.

Elevation and Topography: 4,500 to 7,500 feet in plains and basins, mountains more than 10,000 feet. Steep north-south-trending mountain ranges are separated by broad basins filled with alluvium.

Climate: *Average annual precipitation*—8 to 16 inches over most of the area but as much as 30 inches on mountain slopes; evenly distributed throughout the year although low from midsummer to early autumn. *Average annual temperature*—43° to 47° F. *Average freeze-free period*—90 to 140 days, decreasing with elevation.

Water: Water supplies from rainfall and streamflow are small and unreliable. Streamflow depends largely on accumulated snow on the higher mountains. Ground-water supplies are abundant in the deep fill in valleys but have not been used much.

Soil: *Brown soils* (Lickskillet and Ruckles) and *Chestnut soils* (Newell, Gem, and Elmore) occupy the higher fans and the lower mountain slopes, *Lithosols* the steep slopes, and *Chernozems* the gentle mountain slopes. *Planosols* are prominent on some plateaus. *Sierozems* are the principal soils in the older alluvial deposits of basins and *Alluvial soils* and *Humic Gley soils* (Humboldt) on flood plains of the few major streams. *Solonetz soils* are extensive on the lower parts of the basins.

26—Carson Basin and Mountains

Nevada and California
7,500 square miles

Land Use: Nearly three-fourths of the area is Federally owned; most of the remainder is in farms and

ranches. Grazing of livestock on native grasses and brush is the principal agricultural activity. Narrow bands along the major streams, amounting to 1 or 2 percent of the total area, are irrigated and produce grain, hay, and some tame pasture. About 5 percent of the area on the high mountain slopes is in pinyon-juniper woodland and Jeffrey pine forest.

Elevation and Topography: 4,000 to 6,500 feet in valleys, mountain crests about 11,000 feet. The steeply sloping north-south-trending mountain ranges are separated by broad valleys and basins.

Climate: *Average annual precipitation*—5 to 15 inches; falls mostly as snow in winter; summers are dry. *Average annual temperature*—40° to 52° F. *Average freeze-free period*—60 to 150 days, decreasing with elevation.

Water: The low rainfall provides little water but a few large rivers supply irrigation water along their courses. Ground water is abundant in the valleys but has been little used.

Soil: *Humic Gley soils* (Carson and Bishop) occupy the poorly drained lower fans and flood plains and *Alluvial soils* the better drained young alluvial fans. *Desert soils, Sierozems, Brown soils,* and *Solonchak soils* are the principal soils on the older fans and terraces and *Lithosols* and *Chestnut soils* on the steep mountain slopes.

27—Fallon-Lovelock Area

Nevada
12,200 square miles

Land Use: About four-fifths of the area is Federally owned; most of the remainder is in farms and ranches. Much of the land is used for range, but the native shrubs and sparse grass cover provide only a small amount of grazing. One or two percent of the area, mostly near Lovelock and Fallon, is irrigated and farmed intensively. Sugar beets and potatoes are the important cash crops, but grain, hay, and tame pasture for livestock occupy more acreage.

Elevation and Topography: 3,300 to 6,000 feet in valleys, some mountain peaks more than 8,000 feet. The north-south-trending steep mountain ranges are separated by broad valleys and basins. The few large rivers of the area terminate in playa lakes in the basins.

Climate: *Average annual precipitation*—4 to 12 inches; very low from midsummer to early autumn. *Average annual temperature*—45° to 55° F. *Average freeze-free period*—60 to 150 days, decreasing with elevation.

Water: Water for irrigation is obtained from the few large rivers in the area. Water from rainfall and ground water is scarce in most places, and the ground water is generally too salty to use for irrigation.

Soil: *Alluvial soils* (Lahontan and Fallon) on flood plains and young alluvial fans are the important agricultural soils. *Desert soils* (Woolsey) and *Sierozems* are the main soils on older fans, terraces, basins, and deserts and *Solonchak soils* and *Solonetz soils* (Toy) in the lower parts of the basins. *Lithosols* are the principal soils on steep mountain slopes, but deeper soils in the *Regosol* group are on some of the less sloping areas.

28—Great Salt Lake Area

Utah, Nevada, and Idaho
61,800 square miles

Land Use: Between three-fourths and nine-tenths of the area is owned by the Federal Government, and large tracts are used for training and testing purposes by the Armed Forces and the Atomic Energy Commission. Livestock production on range is the principal agricultural activity over most of the area, but the desert shrubs and grasses have a very low carrying capacity. In most of the area, the extent of the livestock industry is determined largely by the amount of hay, pasture, and grain that can be produced by irrigation from small local water supplies. In the east, irrigated cropland is used for growing potatoes, sugar beets, vegetables, and fruits. The irrigated land amounts to only 1 or 2 percent of the total area.

Elevation and Topography: 4,000 to 6,500 feet in the basins and 6,500 to 11,000 feet in the mountains. Nearly level basins bordered by long gently sloping alluvial fans lie between widely separated north-south-trending steep mountain ranges.

Climate: *Average annual precipitation*—5 to 20 inches; midsummer to early autumn is driest period. *Average annual temperature*—45° to 55° F. *Average freeze-free period*—60 to 160 days, decreasing with elevation.

Water: Water is scarce. Both surface water and ground water are used for irrigation. Streams for the most part are small and intermittent and depend on sources in the higher mountains. Deep wells are possible but costly; shallow wells are unreliable in flow and the water commonly contains large amounts of salt.

Soil: Detailed information is lacking for much of this area. *Alluvial soils* (Penoyer, Oasis, Genola, and Lahontan) on flood plains and young alluvial fans are the important agricultural soils. *Desert soils, Sierozems* (Dixie), and *Calcisols* (Neola, Palisade, and Escalante) are the important soils on old alluvial fans and terraces. *Solonetz soils* (Uvada and Harding) and *Solonchak soils* (Saltair, Cache, and Land) are extensive in the salt and alkali basins. *Lithosols* are believed to be the principal soils on the higher hills and mountains.

29—Southern Nevada Basin and Range

Nevada and California
22,900 square miles

Land Use: More than 90 percent of the area is owned by the Federal Government, and much of it is used for training and testing by military forces. The desert shrubs and sparse grass cover provide only a small amount of grazing. About 3 percent of the land, mostly in valleys in Nevada, is irrigated. Potatoes are the principal cash crop, but much of the irrigated acreage is used to grow grain and forage for livestock.

Elevation and Topography: 2,000 to 5,500 feet in valleys, the higher mountains more than 13,000 feet.

The north-south-trending steep mountains are separated by broad valleys that are bordered by sloping fans and terraces and, in some places, by old beach ridges.

Climate: *Average annual precipitation*—Mainly 3 to 12 inches but as much as 20 inches on mountain slopes; summers are dry. *Average annual temperature*—45° to 60° F., decreasing with elevation. *Average freeze-free period*—120 to 230 days, decreasing with elevation.

Water: Streamflow supplies only a small amount of water for irrigation. Ground-water supplies are small and are mostly untapped. In California most of the water is controlled by the city of Los Angeles and is not available for local use.

Soil: *Alluvial soils* (Lahontan and Penoyer) and *Humic Gley soils* (Bishop and Pahranagat) are the principal soils on valley flood plains and in the younger basin deposits. *Desert soils* and *Calcisols* (Pahroc) are extensive in the coarser alluvial deposits and *Regosols* (Preston and Quincy) in wind-worked or wind-deposited sands. *Lithosols* (Theriot) are the principal soils on steep mountain slopes.

30—Sonoran Basin and Range

California, Arizona, Nevada, and Utah
61,800 square miles

Land Use: About four-fifths of the area is owned by the Federal Government; much of the remainder is owned by local governments. Most of the land is covered by desert vegetation consisting of creosotebush, cacti, mesquite, Joshua trees, and some short grasses. This desert cover is used only locally for grazing because of the low forage production and lack of water for livestock. About 1 percent of the land, consisting of Alluvial soils along the Colorado and Gila Rivers, is irrigated. Cotton and citrus fruits are the major crops, but many kinds of winter vegetables and other crops are grown.

Elevation and Topography: 280 feet below sea level to 4,000 feet above in valleys and basins, some mountain ranges 11,000 feet. Broad basins, valleys, and old lake beds make up most of the area, but there are widely spaced north-south-trending mountains throughout.

Climate: *Average annual precipitation*—2 to 10 inches in valleys but as much as 25 inches on mountain slopes; fairly evenly distributed through the year. *Average annual temperature*—60° to 75° F. but as low as 50° F. in the mountains. *Average freeze-free period*—240 days but much shorter on the higher mountains and as long as 280 days in the south.

Water: Water is scarce. Agriculture depends almost entirely on irrigation water from the Colorado and Gila Rivers. Some large springs in Nevada and wells in both Nevada and California provide some irrigation water.

Soil: *Alluvial soils* (Cajon, Gila, and Hesperia) and *Humic Gley soils* (Foster) are on flood plains of the larger rivers and *Calcisols* (Las Vegas and Mormon Mesa) and *Red Desert soils* (Adelanto, Superstition, Mohave, and Sunrise) on the older alluvial fans and terraces and in the better drained basins. *Solonetz soils* (Pond) are characteristic of the low wide basins, and *Lithosols* occur on steep mountain slopes.

31—Imperial Valley

California
2,500 square miles

Land Use: Intensive irrigated agriculture is practiced in this area. Citrus fruit, dates, grapes, sugar beets, many kinds of vegetables, small grains, flaxseed, hay, and tame pasture grasses are grown. Many livestock are fattened each year in feedlots. Nonirrigated land is in desert vegetation that has only slight value as range. The principal plants are mesquite, arrowweed, yucca, saltcedar, and cacti.

Elevation and Topography: 240 feet below sea level to 600 feet above. This nearly level plain is broken by scattered steep-sided valleys and steep mesas.

Climate: *Average annual precipitation*—2 to 4 inches. *Average annual temperature*—70° to 75° F. *Average freeze-free period*—280 to 350 days.

Water: Agriculture depends almost entirely on water from the Colorado River, but wells provide irrigation water locally.

Soil: *Alluvial soils* (Imperial and Gila) are in the fine- and medium-textured young alluvial deposits and *Regosols* (Indio) in coarse- to medium-textured alluvium and wind-deposited or wind-worked sands.

32—Northern Intermountain Desertic Basins

Wyoming and Montana
9,000 square miles

Land Use: Slightly more than one-half of the area is owned by the Federal Government; the remainder is in farms and ranches. Most of the privately owned land and much of the Federally owned is used for grazing. Range consists mostly of desert shrubs and brush, but short grasses and mid grasses grow on the more favorable sites. Between 3 and 5 percent of the land is irrigated. Alfalfa and other feed crops occupy the largest acreage, but dry beans, sugar beets, and potatoes are important cash crops.

Elevation and Topography: 5,000 to 7,000 feet. Sloping alluvial fans on the outer edges of these large intermountain basins coalesce into broad plains in the centers. Badlands are typical of the dissected parts along the outer edges.

Climate: *Average annual precipitation*—5 to 14 inches; highest in spring and early summer. *Average annual temperature*—About 45° F. *Average freeze-free period*—115 to 140 days.

Water: The low and erratic rainfall provides only a small amount of water. The Big Horn River and its larger tributaries bring irrigation water into the area from the bordering mountains.

Soil: *Desert soils* (Worland) and *Sierozems* are on the outwash-mantled shales and sandstones and *Alluvial soils* (Billings) on the alluvial fans bordering the uplands. *Lithosols* (Chipeta) and badlands occupy the more steeply sloping dissected areas, *Solonetz*

soils (Meeteetse) the small conspicuous areas of alkaline clay shales and alluvial deposits along drainageways, and *Alluvial soils* (Shoshone) the imperfectly drained flood plains.

33—Semiarid Rocky Mountains

Wyoming
6,500 square miles

Land Use: One-fourth or more of the land is owned by the Federal Government; the remainder is in farms and ranches. Most of the privately owned land and much of the public land is grazed. Desert shrubs, mid grasses, and mountain shrubs cover most of the area, but there are open woodlands high in the mountains. Small areas in isolated valleys are irrigated and used for growing hay and grain.

Elevation and Topography: 6,000 to more than 8,000 feet. Isolated mountain ranges that have steep slopes and narrow valleys rise sharply from desert basins.

Climate: *Average annual precipitation*—12 to 16 inches; highest in spring and early summer. *Average annual temperature*—About 45° F. *Average freeze-free period*—Less than 120 days, decreasing with elevation.

Water: Water is scarce. The low rainfall, small and intermittent streamflow, and scarcity of ground water seriously limit agriculture.

Soil: The steep upper mountain slopes are mainly rough stony land. *Lithosols* (Stecum and Laporte) occupy the less sloping parts, *Chestnut soils* (Bresser) the intermediate slopes, *Brown soils* the lower slopes, and *Grumusols* some of the areas underlain by basic volcanic rocks.

34—Central Desertic Basins, Mountains, and Plateaus

Wyoming, Colorado, and Utah
45,600 square miles

Land Use: Slightly more than one-half of the area is owned by the Federal Government; the remainder is in farms and ranches. Most of the privately owned land and much of the public land is used for cattle and sheep grazing. Sagebrush, greasewood, other desert shrubs, short and mid grasses form the principal cover; pinyon-juniper woodlands are on the high mountains and plateaus where there is more rainfall. Between 2 and 5 percent of the land, mostly along the few large streams, is irrigated. Hay and pasture occupy a large part of the irrigated land, but deciduous fruits, beans, and sugar beets are important crops in the south. Small areas that have deep soils and receive enough rainfall are dryfarmed to wheat and other crops.

Elevation and Topography: 4,500 to 7,500 feet in basins and on plateaus, the few mountain ranges 1,000 to 2,000 feet higher. Broad intermountain basins and a few isolated small mountain ranges merge into a dissected plateau in the south. Sloping alluvial fans at the edges of the basins merge into flat plains in the center. The plateaus have gently sloping tops that are cut by steep-walled canyons.

Climate: *Average annual precipitation*—7 to 12 inches; fairly evenly distributed through the year. *Average annual temperature*—40° to 52° F. *Average freeze-free period*—Less than 100 days in most of area but as long as 180 days in the south.

Water: Water is scarce. Irrigation water is available along the few large streams that bring water into the area from adjoining mountains. Ground-water supplies are meager and little developed.

Soil: *Desert soils* (Worland, Orchard, and Mesa) and *Sierozems* in weakly consolidated sediments or old alluvium are extensive. *Alluvial soils* (Green River, Billings, and Uncompahgre) are in the young alluvial deposits along the few perennial streams, *Solonetz soils* in many small areas and basins, and *Lithosols* (Santana and Persayo) and rough broken land on canyon walls, deeply dissected fans, and mesa sides. *Chernozems* (Bridger) and *Gray Wooded soils* (Uinta) occur in small areas on the higher mountain slopes.

35—Colorado and Green Rivers Plateaus

Utah and Arizona
42,600 square miles

Land Use: Less than one-third of the area is in privately owned farms and ranches; the remainder is in Indian reservations or is owned by the Federal Government. Grand Canyon and Zion National Parks and several national monuments are within the area. Much of the land has an open grass-shrub cover, and there are pinyon-juniper woodlands on the higher plateaus and mesas. A small amount of grazing is obtained from this land. About 1 or 2 percent of the land, consisting of flood plains and alluvial fans, is irrigated. Feed and forage for livestock are the main crops, but potatoes and sugar beets are important cash crops. A slightly larger total acreage in areas that have enough rainfall, mostly in the south, is dryfarmed to wheat and other crops.

Elevation and Topography: 5,000 to 7,000 feet over most of the area, some high plateaus and mountains 10,500 feet. Gently sloping plateaus and mesas are deeply and abruptly cut by canyons. Stream valleys are narrow and widely spaced.

Climate: *Average annual precipitation*—6 to 16 inches; fairly evenly distributed throughout the year but low in early summer. *Average annual temperature*—45° to 55° F. *Average freeze-free period*—100 to 220 days, decreasing with elevation.

Water: Water is scarce. Streamflow is generally small and intermittent but some water is stored in reservoirs. Ground water from deep wells is costly, and water from shallow wells is usually high in salts and fluctuates in amount.

Soil: Detailed information is lacking for much of this area. *Alluvial soils* (Redfield, Tours, and Navajo) along the flood plains are the important agricultural soils. *Sierozems* (Blanding) and *Calcisols* (Mellenthin) occupy the plateau tops, older terraces, and alluvial fans. *Lithosols* (Moenkopie) and badlands or rough broken land are extensive in the mountains and on plateaus.

36—New Mexico and Arizona Plateaus and Mesas

New Mexico and Arizona
26,200 square miles

Land Use: About one-fifth of the area is owned by the Federal Government; an equal or larger part is in Indian reservations. The remainder is in farms, ranches, or other private holdings. Desert shrubs and short grasses cover most of the area, but there are open pinyon-juniper woodlands at high elevations. Most of this land, both privately and publicly owned, is used for range. Less than 1 percent of the total area is cropland. Most of it is irrigated and used for growing hay and tame pasture grasses, but cash crops are grown locally. In the southwest, small areas are dryfarmed to grain and hay.

Elevation and Topography: 5,000 to 7,000 feet, a few isolated mountains more than 8,000 feet. These plateaus and mesas have gentle slopes except for precipitous slopes along valley walls and edges of mesas.

Climate: *Average annual precipitation*—10 to 13 inches in most of the area and 15 inches at higher elevations; about two-thirds falls from midsummer to early autumn. *Average annual temperature*—About 50° F. *Average freeze-free period*—120 to 180 days, increasing from east to west.

Water: Because of the low rainfall and sparse streamflow, water is scarce. A small amount of water for irrigation is available along the major streams that flow into the area from surrounding mountains.

Soil: *Sierozems* (Chacra) are extensive in the drier parts of the area and *Reddish-Brown soils* (Corduroy and Prieta) and *Brown soils* (Progresso) at higher elevations. *Regosols* (Otero and Preston) in deep sands and *Alluvial soils* (Billings, Woodrow, Puerco, Tours, and Prewitt) on flood plains are important throughout the area. On the steeper slopes of canyon walls and mesa breaks, rock outcrops and rough broken land are common as are *Lithosols* (Travessilla, Persayo, and Oro Grande).

37—San Juan River Valley Mesas and Plateaus

New Mexico
4,700 square miles

Land Use: About half the area is in range of desert shrubs and short grasses. An additional 10 percent, mainly at higher elevations, is pinyon-juniper woodland that provides some grazing. About one-third of the area is owned by the Federal Government and some of it is grazed. Between 1 and 2 percent is irrigated cropland in narrow discontinuous bands along the San Juan River and its larger tributaries. Grain and hay for livestock feed are the main crops, but fruits, vegetables, and other cash crops are also grown.

Elevation and Topography: 5,000 to 6,000 feet. Gently sloping broad valleys and plains are bordered by deeply dissected bands of steep slopes and sharp local relief. Other steeply sloping areas are the margins of mesas and a few isolated low mountain ranges.

Climate: *Average annual precipitation*—7 to 10 inches; about two-thirds falls from midsummer to early autumn. *Average annual temperature*—About 50° F. *Average freeze-free period*—140 to 160 days.

Water: The low rainfall and intermittent streamflow provide only a small amount of water for agriculture. Only the few major streams supply enough water for irrigation. Ground water is scarce and of poor quality and is mostly untapped.

Soil: *Sierozems* (Blanding) and *Desert soils* (Mesa) are the principal soils. *Alluvial soils* (Billings, Christainburg, Genola, and Tours) occur on the narrow flood plains of major streams and on some of the younger and lower alluvial fans and *Regosols* (Preston) in windblown sands in the same positions. *Lithosols* (Persayo) are very extensive and there are large areas of badlands in the dissected belts adjacent to the major stream valleys.

38—Black, Hualpai, and Cerbat Mountains

Arizona
6,500 square miles

Land Use: About two-thirds of the land is owned by the Federal Government and an additional 10 percent or more is in Indian reservations. The small remaining part is in farms and ranches. Between 5 and 10 percent of the area at high elevations is in open woodland; desert shrubs and grasses cover most of the remainder. A large part of both publicly and privately owned land is used for range. Small areas on flood plains and in small basins are irrigated from deep wells and used mostly to grow grain and forage although cotton is an important cash crop. Other small areas are dryfarmed to grain and hay.

Elevation and Topography: 2,000 to 4,500 feet in valleys and basins, mountain peaks 8,300 feet. North-south-trending steep mountain ranges are separated by broad valleys and basins.

Climate: *Average annual precipitation*—10 to 14 inches; fairly evenly distributed throughout the year. *Average annual temperature*—58° to 65° F. *Average freeze-free period*—190 to 240 days.

Water: Water is scarce throughout the area, which limits its use for range. Deep wells are the principal source of irrigation water in the valleys.

Soil: Detailed information is lacking. *Lithosols* are dominant on mountain slopes and cover a very large part of the area. In the valleys *Alluvial soils* occupy the younger flood plains and fans, and *Red Desert soils*, *Reddish-Brown soils*, and *Calcisols* the higher fans, terraces, and foothills.

39—Arizona and New Mexico Mountains

Arizona and New Mexico
35,100 square miles

Land Use: About three-fifths of the area is owned by the Federal Government, and an additional 10 percent or more is in Indian reservations. Much of this area is so rough and steep that it has little economic use. About two-fifths of the total area is used for range. At lower elevations the range consists of mixed grasses, chapparal brush, and pinyon-juniper woodland. About 5 percent of the area, the upper mountain

slopes and crests, is in forests of spruce, fir, and ponderosa pine. Mining is important in some of these mountains. Less than 1 percent of the area, mainly in narrow valleys, is irrigated from streamflow or wells. Hay, pasture grasses, and grain are the main crops, and orchards and vegetables are important in some valleys.

Elevation and Topography: 4,500 to 10,000 feet, some mountain crests 12,600 feet. This area consists mostly of steep foothills and mountains, but it includes some deeply dissected high plateaus.

Climate: *Average annual precipitation*—10 to 35 inches, increasing with elevation; highest from midsummer to early autumn; mostly snow in the mountains. *Average annual temperature*—Mainly 40° to 55° F., decreasing with elevation. *Average freeze-free period*—40 to 150 days in most of area, decreasing with elevation; 240 days in the lower foothills.

Water: Many of the larger streams flow the year round, but the volume of water fluctuates widely. Some water is stored in reservoirs. Ground water is scarce and so deep that pumping to the surface is expensive. Springs and shallow wells provide stock water in many places.

Soil: Detailed information is lacking for much of the area. *Brown soils, Reddish-Brown soils,* and *Reddish Chestnut soils* are the principal soils in the foothills and valleys and *Gray Wooded soils, Brown Forest soils,* and *Podzols* on the upper mountain slopes and crests, but *Lithosols,* stony land, and rock outcrops occupy large areas on both mountains and foothills.

40—Central Arizona Basin and Range

Arizona
19,000 square miles

Land Use: About one-half of the land is owned by the Federal Government and an additional 10 percent is in Indian reservations. About 10 percent of the area, mainly along the Gila and Salt Rivers, is irrigated. Where water is of high quality, the principal crops are vegetables and cotton; where water is of poor quality, tame pasture is the principal use. The large unirrigated acreage has little economic use, but some grazing of the desert shrubs and short grasses is possible in favorable seasons.

Elevation and Topography: 1,000 to 2,500 feet, higher mountain ranges 5,000 feet. Low basins bordered by gently sloping alluvial fans are separated by steep north-south-trending mountain ranges.

Climate: *Average annual precipitation*—5 to 10 inches; highest in midsummer and midwinter. *Average annual temperature*—60° to 74° F. in most of the area, decreasing to 55° F. in the foothills along the northern edge. *Average freeze-free period*—225 to 300 days.

Water: Water for irrigation is provided mainly by reservoirs along the Gila and Salt Rivers. Deep wells provide irrigation water in some places, but the water table is dropping steadily. Except for the few major rivers, streams are few and poorly defined and flow only after local storms.

Soil: The most extensive soils are *Red Desert soils* on the older alluvial fans and terraces, *Alluvial soils* on flood plains and the younger alluvial fans, *Calcisols* in highly calcareous materials, and *Lithosols* on valley walls and mountain slopes.

41—Southeastern Arizona Basin and Range

Arizona
17,700 square miles

Land Use: Nearly one-third of the area is owned by the Federal Government; the remainder is in farms, ranches, and other privately owned holdings. The vegetation consists of desert shrubs and short grasses at lower elevations, grass and mesquite at mid elevations, and ponderosa pine woodland that has a grass ground cover at high elevations where moisture is more plentiful. Between one-half and three-fourths of the area is used for range, and livestock production on range is the principal agricultural activity. One or two percent of the area, land along the upper Gila River and its large tributaries, is irrigated. Cotton and alfalfa are the main crops, but specialty crops are important locally. Where water is of poor quality and less certain in amount, grain and forage to supplement range feed are the main crops. About 1 percent of the land is dryfarmed to hay and grain.

Elevation and Topography: 2,500 to 6,000 feet, isolated peaks and ranges 10,000 feet. Widely spaced narrow mountain ridges and peaks rise sharply from this nearly level broad plain. There are some basins and dry lake beds.

Climate: *Average annual precipitation*—8 to 20 inches; highest at high elevations; low in spring and early summer and fairly evenly distributed through the rest of the year. *Average annual temperature*—55° to 70° F. *Average freeze-free period*—180 to 240 days.

Water: The upper Gila River and its tributaries are the only year-round sources of surface water for irrigation. Much of the irrigation water is obtained from deep wells, but the declining water table and a high salt content limit the usefulness of this source.

Soil: *Red Desert soils, Brown soils, Reddish-Brown soils,* and *Calcisols* are the principal soils in much of this area. *Alluvial soils* are extensive on flood plains and on the lower younger alluvial fans. *Lithosols* occupy most of the mountain slopes.

42—Southern Desertic Basins, Plains, and Mountains

New Mexico, Texas, and Arizona
62,000 square miles

Land Use: About one-third of the land is owned by the Federal Government; most of the remainder is in farms, ranches, or other private holdings. The Federally owned land is concentrated in New Mexico. Two-thirds or more of the total area is in range. Short grasses and desert shrubs cover much of the area, but there are open pinyon-juniper woodlands at high elevations. All this range has a low carrying capacity. Less than 1 percent, consisting mainly of narrow discontinuous strips along the Rio Grande

and Pecos Rivers, is irrigated. Other small areas are irrigated from wells. Cotton, cantaloupes, and vegetables are the principal crops; grain sorghum, alfalfa, and other feed and forage crops are grown also.

Elevation and Topography: 2,500 to 5,000 feet in basins and valleys and more than 8,000 feet in the mountains. Broad desert basins and valleys are bordered by gently to strongly sloping fans and terraces. There are steep north-south-trending mountain ranges and many small mesas in the western part.

Climate: *Average annual precipitation*—8 to 16 inches; highest from midspring to midautumn. *Average annual temperature*—50° to 65° F. *Average freeze-free period*—200 to 240 days in most of area but 180 days in the northern ends of the Pecos and Rio Grande valleys.

Water: Surface water and rainfall are scarce throughout the area, which imposes severe restrictions on its use for range. The Rio Grande and Pecos Rivers and a few of their larger tributaries are the only perennial streams. Ground water in deep valley fill provides water for domestic use and livestock and locally for some irrigation.

Soil: *Red Desert soils* (Mohave and Tijeras) and *Lithosols* (Cottonwood) are the dominant soils of the area. Others are *Calcisols* (Reagan, Reeves, and Karro) in highly calcareous materials and *Regosols* (Tivoli, Preston, and Cowan) in deep sands. *Reddish-Brown soils* (Brownfield) are extensive east of the Pecos River. *Alluvial soils* (Brazito, Vinton, Gila, Glendale, and Imperial) in the valleys are the principal soils used for crops.

E—ROCKY MOUNTAIN RANGE AND FOREST REGION

236,800 square miles

Rugged mountains are the dominant feature of this region, but there are some broad valleys and remnants of high plateaus. The annual precipitation ranges from 20 to 40 inches over much of the region, but it is less than 10 inches in some valleys and 50 inches or more on some of the mountain peaks. Average annual temperatures are mostly 40° to 45° F., but they range from 35° to 50° F. The freeze-free season is 100 to 140 days in most valleys and basins but decreases to 40 days or less in the high mountains where frosts occur every month of the year. Some of the highest mountains are covered by glaciers and have permanently frozen ground. Foothills in the southern part have a freeze-free season as long as 160 days.

Chestnut soils, Chernozems, and Brown soils are the dominant soils in valleys and on the lower mountain slopes and Gray-Brown Podzolic soils, Gray Wooded soils, Podzols, and Alpine Meadow soils on the upper mountain slopes and crests. Lithosols and rockland are extensive on the steep mountain slopes, and Alluvial soils are important in valleys.

Grazing is the leading land use in both valleys and mountains, but lumbering is important in some of the forested mountain areas. Recreation is an important land use throughout the region. Irrigation agriculture is practiced in some of the valleys and dryfarming in others. Grain and forage for livestock are the main crops; beans, sugar beets, peas, and seed crops are also grown where soils, climate, and markets are favorable.

43—Northern Rocky Mountains

Idaho, Washington, Oregon, Montana, and Wyoming
100,000 square miles

Land Use: About four-fifths of the area is owned by the Federal Government. Yellowstone and Glacier National Parks and several other parks, forests, and monuments are in the area. Heavy forests of western white pine, ponderosa pine, lodgepole pine, larch, hemlock, Douglas-fir, and spruce cover much of the land at the upper and intermediate elevations. On lower slopes, especially in the south, forests are more open and have an undergrowth of shrubs and grasses. All the forested areas are used as wildlife habitat and for recreation; they produce timber as well. Mining is important in northern Idaho and western Montana. Meadows on the upper mountain slopes and mountain crests above timberline are used to some extent for summer grazing. Less than 2 percent of the area is cropped. Forage and grain grown under irrigation in some of the valleys provide feed for dairy cattle and other livestock. In Washington and Oregon, valleys that have enough rainfall are dryfarmed to wheat, peas, and a few other crops.

Elevation and Topography: Mostly 4,000 to 8,000 feet but ranges from 3,500 feet to more than 12,000 feet. High mountains having steep to precipitous slopes and sharp crests are cut by narrow valleys that have relatively steep gradients. In the western part, some high plateaus are dissected by deep steep-walled canyons. Large lakes are common at higher elevations, especially in the glaciated areas.

Climate: *Average annual precipitation*—Mainly 20 to 50 inches, increasing with elevation, and less than 15 inches in some valleys; most of the precipitation during fall, winter, and spring is snow; summers are dry. *Average annual temperature*—Mainly 35° to 45° F. but 50° F. or more in some low valleys; some of the highest mountains are continuously covered by ice and snow. *Average freeze-free period*—60 to 135 days, decreasing with elevation.

Water: The moderate precipitation and the many perennial streams provide enough water, including that needed for irrigation in the cultivated valleys. The streams also supply water to adjoining areas for irrigation and other purposes. Springs and shallow wells in the valleys provide a moderate amount of water for domestic use and livestock. Elsewhere, ground-water supplies are small and mostly untapped.

Soil: Detailed soil information is lacking for most of the area. *Alpine Meadow soils* (Ptarmigan and Vasquez) are on the upper slopes and crests of many of the mountains. On forested mountain slopes *Brown Podzolic soils* (Helmer, Waits, Bonner, and Holloway), *Gray Wooded soils* (Uinta, Woodrock, Whitefish, Tongue River, and Lake Creek), and *Gray-Brown Podzolic soils* are extensive. Rock outcrops, rough stony land, rough broken land, and *Lithosols* (Duncom) occupy the steepest slopes. Soils on the lower slopes grade from *Brunizems* (Burgess) to *Chernozems* (Mires and Little Horn) and *Chestnut soils* (Skalkaho, Buena Vista, and Avon) with decreasing elevation. *Brown soils* (Garo) are on the lowest slopes, which receive the least rainfall.

44—Northern Rocky Mountain Valleys

Montana and Idaho
16,200 square miles

Land Use: Nearly all the area is in farms and ranches. As much as one-third of the land in some valleys is irrigated. Potatoes, sugar beets, and peas are important cash crops, but hay, grain, and pasture for livestock feed occupy a much larger acreage. Some areas that have enough rainfall are dryfarmed to wheat and

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peas. Between one-third and one-half of the area is in range of native grasses and shrubs. Beef cattle and sheep are the principal livestock, but dairying is important near the larger towns. Much of the area in northern Idaho is forested, and elsewhere many steep and stony soils are in woodland. These forests yield some lumber and are also used for grazing.

Elevation and Topography: 2,000 feet to as much as 6,000 feet, highest in southwestern Montana. The deep valleys bordered by mountains are mostly north-south trending. In the valleys, nearly level broad flood plains are bordered by gently to strongly sloping terraces and fans. In many places the valleys have been modified somewhat by glaciation, and in the north lacustrine sediments cover much of the valley floors. Local relief within any given valley is slight to moderate.

Climate: *Average annual precipitation*—12 to 16 inches in most of area and 20 inches to 33 inches in northern Idaho; fairly evenly distributed through fall, winter, and spring but low in summer; most of the winter precipitation is snow. *Average annual temperature*—40° to 47° F. *Average freeze-free period*—100 to 120 days in much of the area, 80 days or less at the highest elevations, and 140 days or more at the lowest.

Water: Perennial streams flowing into the area from surrounding mountains are the principal sources of water. The amount is usually adequate but depends on the snow accumulation in the mountains. Ground water is abundant in the deeper unconsolidated fill materials and is used to some extent for irrigation. Rainfall is adequate to permit some dryfarming at higher elevations and throughout the area in northern Idaho.

Soil: *Alluvial soils* (Chamokane, Corvallis, and Gallatin) on flood plains and young alluvial fans are the principal agricultural soils. *Humic Gley soils* (Lamoure) and *Low-Humic Gley soils* (Radnor) on wet flood plains are extensive, mainly in the north. *Brown soils* (Musselshell, Riverside, and Avalanche) occupy terraces and fans at the lower elevations where rainfall is low, *Chestnut soils* (Skalkaho, Martinsdale, and Kalispell) similar positions where moisture is more plentiful, and *Chernozems* (Bridger, Bozeman, Creston, McDonald, and Flathead) where the moisture supply is even more favorable. *Solonetz soils* (Post, Ravalli, Haccke, and Round Butte), *Regosols* (Kiwanis and Blanchard) in deep unconsolidated materials, and *Lithosols* (Laporte, Spring Creek, and Stecum) on steep slopes are other important soils. *Gray Wooded soils* (Crow and Whitefish) and *Brown Podzolic soils* (Cabinet, Waits, and Bonner) are on the highest foothills and spurs.

45—Alpine Meadows and Rockland

Montana, Colorado, and Wyoming
10,700 square miles

Land Use: Most of the land is owned by the Federal Government. Alpine grasses, herbaceous plants, and shrubs cover much of the area but small parts are forested. This cover provides some summer grazing for sheep, but wildlife habitat and recreation are the principal uses. Small valleys are irrigated and used for growing hay, tame pasture, and some grain for livestock.

Elevation and Topography: 8,500 to 14,500 feet, mostly more than 10,000 feet. The rolling to steep or precipitous upper mountain slopes and crests are covered in places by snowfields and glaciers.

Climate: *Average annual precipitation*—Mostly 20 to 40 inches, less locally, and more than 50 inches in some places; fairly evenly distributed throughout the year but somewhat higher in winter; much of it is snow. *Average annual temperature*—32° to 40° F., decreasing with elevation; some of the highest areas are perpetually frozen. *Average freeze-free period*—Mainly less than 40 days and as long as 80 days in some parts.

Water: The heavy snowfall feeds streams that provide water for lower areas.

Soil: Detailed information is lacking. Most of the soils have dark surface layers high in organic matter and have been tentatively classified as *Alpine Meadow soils* (Ptarmigan and Vasquez) or as *Bog soils* (Nystrom). Some have perennially frozen layers (permafrost) and are similar to soils of arctic regions. Rock outcrops and rough stony land with little or no soil cover are extensive.

46—Northern Rocky Mountain Foothills

Montana and Wyoming
23,000 square miles

Land Use: About one-fifth of the land is owned by the Federal Government; the remainder is in farms and ranches. One-half or more of the area is in range of short and mid grasses and some shrubs. Many of the valleys are irrigated, but they amount to only 1 or 2 percent of the total area. Grain and forage for livestock are the main crops, but potatoes, sugar beets, peas, and some other crops are grown also. About one-fifth of the area, mainly along the northeastern side, is dryfarmed to wheat. Some of the highest hills are in forest.

Elevation and Topography: 3,700 to 6,000 feet in the north, increasing gradually to 6,000 or 8,000 feet in the south and in central Wyoming. The rugged hills and low mountains are cut by many narrow valleys that have steep gradients. Broad flood plains and fans border a few of the major rivers.

Climate: *Average annual precipitation*—Mainly 12 to 20 inches, 30 inches at highest elevations, and 10 inches in some basins; the maximum is in spring in the north and in early summer in the south; winter precipitation is snow. *Average annual temperature*—45° to 50° F. *Average freeze-free period*—Mainly 100 to 120 days but only 80 days at highest elevations.

Water: Rainfall is too low for successful crop production in some of the area but is adequate for grain farming and forage production in other parts. The major rivers provide most of the water for irrigation, but small streams furnish local supplies. Ground

water is abundant in the fill in some valleys, but over most of the area ground-water supplies are meager or lacking.

Soil: *Chestnut soils* (Fairfield, Martinsdale, and Grail) are the most extensive, but *Brown soils* (Wolf, Big Horn, Bew, and Musselshell) occur in the drier parts. Also extensive on the steeper hill slopes and valley walls are *Lithosols* (Lismas, Cheadle, Midway, and Spring Creek). *Alluvial soils* (Green River, Havre, Lohmiller, Chamokane, and Banks) occupy the flood plains and young alluvial fans and *Solonetz soils* (Arvada, Beckton, and Gilt Edge) the small basins and depressions. Some *Brunizems* and *Chernozems* (Teton, Little Horn, and Woodhurst) are on the moist higher foothills.

47—Wasatch and Uinta Mountains

Utah, Idaho, and Colorado
22,000 square miles

Land Use: Less than one-third of the area is in farms and ranches. Most of the remainder is owned by the Federal Government, and there are several national parks and monuments in the area. Some land is in Indian reservations. The upper mountain slopes and crests are in alpine meadow and the lower slopes in grass and sagebrush. There are open woodlands at intermediate elevations and some dense forests on moist sites. Both grassland and woodland are used for summer grazing. Recreation and mining are other important uses of land in the area. A few of the large valleys are irrigated; forage for livestock is the main crop, but other crops are grown also.

Elevation and Topography: 5,000 to 9,000 feet, some peaks 13,500 feet. These strongly sloping to precipitous mountains have narrow crests and valleys. Some high plateaus have gently sloping tops and steep sides. The mountains are dissected by many streams, and lakes are common on mountain crests that have been glaciated.

Climate: *Average annual precipitation*—Mainly 12 to 20 inches but as much as 40 inches on some mountain peaks; evenly distributed through the year; much of the precipitation is snow. *Average annual temperature*—35° to 47° F., decreasing with elevation. *Average freeze-free period*— Mainly 60 to 120 days but as short as 30 days on the high mountain peaks.

Water: Streams, lakes, and ground water supply enough water for the range and forestry enterprises of most of the area. Perennial streams also provide irrigation water in the few major valleys.

Soil: Detailed information is lacking for most of the area. On the forested parts of the mountains *Gray Wooded* soils are dominant, but *Lithosols* and rock outcrops occupy large areas on the steepest slopes. At lower elevations, *Brunizems* and *Chestnut soils* are extensive as are *Alluvial soils* on the flood plains of a few large rivers.

48—Southern Rocky Mountains

Colorado, Wyoming, New Mexico, and Utah
54,300 square miles

Land Use: Slightly more than one-half of the land is owned by the Federal Government; the remainder is in farms, ranches, or other private holdings. The upper mountain slopes are in forests of Engelmann spruce, lodgepole pine, Rocky Mountain Douglas-fir, and ponderosa pine. Oak brush and open pinyon-juniper woodlands are at intermediate elevations, and grasses, sagebrush, and other shrubs grow on the lower slopes and in valleys. Most of the grassland and much of the more open woodland is grazed. Recreation and mining are important throughout these areas also. Some hay is harvested from irrigated meadows in valleys, and fruit and vegetables are grown in some irrigated valleys in New Mexico. At lower elevations the gently sloping mesas and uplands are dryfarmed to wheat and beans.

Elevation and Topography: 5,000 to 11,000 feet, some peaks 14,500 feet. These strongly sloping to precipitous mountains are dissected by many narrow stream valleys with steep gradients. High plateaus and steep-walled canyons are fairly common, especially in the west.

Climate: *Average annual precipitation*—Mainly 10 to 30 inches but as much as 40 inches or more on some of the higher mountains; most of the precipitation falls in winter as snow. *Average annual temperature*—35° to 50° F. *Average freeze-free period*—100 to 140 days at lower elevations, 160 days in the southern foothills, and 10 to 80 days at higher elevations.

Water: Water is abundant from streams and lakes, and ground water is plentiful. The lower valleys depend on streamflow for irrigation water.

Soil: Very little information is available. *Gray Wooded soils*, *Brown Forest soils*, *Podzols*, and *Gray-Brown Podzolic soils* are on the forested upper slopes and *Alpine Meadow soils* in the high narrow valleys. Rockland is extensive, especially at higher elevations. Some *Chernozems* and *Chestnut soils* (Monticello) occur on the lower slopes but *Lithosols* are widespread in these areas.

49—Southern Rocky Mountain Foothills

Colorado and Wyoming
5,700 square miles

Land Use: At least four-fifths of the land is in farms and ranches; nearly all of the remainder is owned by the Federal Government. Open woodlands of pinyon, juniper, and some ponderosa pine are at high elevations and oak brush, other shrubs, and short grasses on the lower slopes and in valleys. Both grassland and woodland are widely used for grazing. Hay, pasture, and feed grains are grown in irrigated valleys, which amount to less than 5 percent of the total area; even smaller areas are dryfarmed to wheat.

Elevation and Topography: 5,500 to 8,000 feet. These rugged hills and low mountains are in narrow bands along the eastern slopes of the Rocky Mountains. They are much dissected, and in many places they are crossed by large streams flowing eastward from the Rocky Mountains. Local relief is several hundred feet in most places.

Climate: *Average annual precipitation*—15 to 20 inches; low in winter, increasing through spring to

midsummer, and decreasing in autumn. *Average annual temperature*—40° to 50° F. *Average freeze-free period*—Mainly 120 to 160 days but shorter at higher elevations, especially in the north.

Water: The major streams crossing the area provide irrigation water for the narrow belts of cropland in their valleys, but elsewhere water is scarce.

Soil: Very little detailed information is available. *Gray Wooded soils* (Kettle) are dominant at high elevations and *Chestnut soils* (Wellsville) and *Brown soils* (Stoneham and Terry) at lower elevations. There are some *Regosols* (Berthoud) in wind-deposited or wind-altered sands and *Alluvial soils* on flood plains in the larger valleys. *Lithosols* (Laporte and Travessilla) on steep mountain slopes and valley walls are probably the most extensive soils.

50—San Luis Valley

Colorado
1,200 square miles

Land Use: Most of this area is irrigated cropland, but wet meadows and areas of desert native range are scattered throughout. In the closed basin north of the Rio Grande, crops are subirrigated. Potatoes, malting barley and other small grains, field peas, and sweetclover are the major crops. Outside the closed basin, the principal crops grown under surface irrigation are small grains, field peas, cool-season vegetables, and hay. Wet meadows are used for both hay and grazing. The native range of greasewood, rabbitbrush, other desert shrubs, and salt grass has low grazing value.

Elevation and Topography: 7,500 to 7,700 feet. These nearly level broad valleys are deeply filled with old alluvium. Local relief is slight.

Climate: *Average annual precipitation*—Mainly 6 to 8 inches, increasing to 10 inches in some foothills. *Average annual temperature*—About 42° F. *Average freeze-free period*—100 to 120 days.

Water: Irrigation water is obtained from the Rio Grande River and ground water and is applied mostly by subirrigation methods. The water table is maintained at a depth of 20 to 30 inches in many of the coarse-textured soils. Surface irrigation is used on the fine-textured soils. Salinity is a problem in much of the area.

Soil: Coarse- to medium-textured *Alluvial soils* (Alamosa) that are partly calcareous and slightly to moderately affected by alkali and salts are the most extensive. *Desert soils* and *Sierozems* are on older terraces and fans and *Regosols* in deep sandy deposits.

51—High Intermountain Valleys

Colorado and New Mexico
4,700 square miles

Land Use: Nearly one-half of the land is owned by the Federal Government; the remainder is in farms and ranches. The Great Sand Dune National Monument is in this area. Desert shrubs and some short grasses cover most of the land, but the sand dunes are barren. Blue grama grassland and open pinyon-juniper woodland are at high elevations. Both woodland and grassland are used for summer grazing, but they have a low carrying capacity. A few valleys, less than 5 percent of the total area, are irrigated. Most of the irrigated land is in hay meadow, but peas, lettuce, potatoes, and other vegetables are important cash crops in New Mexico. A small amount of land is dryfarmed to wheat.

Elevation and Topography: 7,000 to 9,000 feet. Nearly level to gently sloping old valley fill covers much of the area. Gently sloping to steep hills underlain by basalt are extensive in the south. Local relief is slight except in the south where it is as much as several hundred feet.

Climate: *Average annual precipitation*—6 to 20 inches, increasing from north to south; falls mostly during the growing season. *Average annual temperature*—40° to 50° F. *Average freeze-free period*—100 to 140 days.

Water: In the north low rainfall supports only a sparse cover of range plants, but in the south rainfall is adequate to support a good cover of grass and sagebrush. Some irrigation water is provided by small reservoirs on intermittent streams flowing into the area from surrounding mountains. The Chama River is an important water source in the south. Wells that tap ground water in the deep valley fill are also important sources of water for irrigation and domestic use.

Soil: Detailed information is lacking for much of the area. *Lithosols* (Apache) derived principally from basalt are dominant in the west and coarse-textured *Regosols* and dune land in the east. *Reddish-Brown soils* (Prieta), *Desert soils* (Hondo), and *Solonetz soils* are in deep coarse old valley-fill materials. Medium-textured *Alluvial* soils over gravel are of small total extent but are important for crops.

F—NORTHERN GREAT PLAINS SPRING WHEAT REGION

131,100 square miles

The fertile soils and the dominantly smooth topography of this region are favorable for agriculture, but the low rainfall and short growing season severely restrict the crops that can be grown. The annual precipitation ranges from 10 to 24 inches, and a large part of it occurs during the growing season. Average annual temperatures are 40° to 45° F. over most of the region. The freeze-free season ranges from 100 to 145 days, increasing in length from north to south.

Chernozems and Chestnut soils are dominant in most of the region, but Brown soils cover the western part. Other important soils are Lithosols on steep slopes, Solonetz soils, Solonchak soils, and Humic Gley soils on terraces and in depressions, and narrow bands of Alluvial soils along the major streams.

The production of spring wheat by dryfarming methods dominates the agriculture of the region. Other spring grains, flax, and hay are also grown. Potatoes are grown in many places, and sugar beets and corn are important in the Red River valley in the east.

52—Brown Glaciated Plain

Montana
19,700 square miles

Land Use: Nearly all the land is in farms and ranches. Level areas, mostly in the west and amounting to almost one-half of the total area, are cropped. Spring wheat is the major cash crop, but feed grains and hay are also grown on most farms. In the east, most of the land is in range although the gentle slopes are dryfarmed to wheat. Narrow discontinuous strips along the Missouri River are irrigated. Feed grains (including corn), hay, and tame pasture occupy much of the irrigated land, and sugar beets are an important cash crop.

Elevation and Topography: 2,000 to 4,000 feet, increasing from east to west and with distance from the Missouri River. This glaciated plain is nearly level to gently rolling, but belts of steep slopes border some of the larger rivers. The Missouri River has extensive flood plains, but along other streams flood plains are narrow and discontinuous.

Climate: *Average annual precipitation*—10 to 15 inches; highest from midspring to midautumn; winter precipitation is snow. *Average annual temperature*—40° to 44° F. *Average freeze-free period*—100 to 120 days.

Water: Most of the area depends on rainfall for water for both range and crops. The Missouri River provides irrigation water to its flood plains and immediately adjacent areas. In the uplands water, mainly for livestock, is stored in small reservoirs. The glacial drift yields a moderate amount of ground water that is hard but otherwise of good quality.

Soil: *Brown soils* (Scobey and Joplin) on gentle slopes and *Regosols* (Zahl) on more sloping areas, both underlain by calcareous glacial till, are the major soils. Associated with them in many small areas are *Solonetz soils* (Phillips). *Lithosols* (Lismas) and rough broken land are extensive on the more sloping areas underlain by calcareous shales. *Chestnut soils* occur where there is a little more rainfall, mainly along the southwestern and western borders, and *Alluvial soils* (Lohmiller, Bowdoin, and Havre) on the flood plains of the Missouri River and a few of its major tributaries.

53—Dark Brown Glaciated Plain

North Dakota, Montana, and South Dakota
29,100 square miles

Land Use: Nearly all this area is in farms and ranches, and slightly more than half is cropland. Spring wheat is the most important crop, and feed grains and forage are grown on a large acreage. Flax is grown on some farms, and some sugar beets are grown on irrigated land in the west. About two-fifths of the area, the more sloping land, is in range of native grasses.

Elevation and Topography: 1,500 to 3,000 feet, increasing gradually from southeast to northwest. This gently rolling glaciated plain includes some areas of kames and moraines that have irregular topography. Steep slopes and badlands border the major valleys.

Climate: *Average annual precipitation*—15 to 18 inches; highest in the growing season; winter precipitation is snow. *Average annual temperature*—40° to 46° F. *Average freeze-free period*—105 to 140 days.

Water: Because rainfall is low and somewhat erratic, conservation of moisture is essential. The only dependable source of water for irrigation is the Missouri River, and irrigated cropland is confined to a narrow band along its valley. Water for livestock is stored locally in small reservoirs in the uplands. Small to moderate amounts of ground water are available.

Soil: *Chestnut soils* (Williams) on gentle slopes and *Regosols* (Zahl) on steeper slopes, all derived from calcareous glacial till, are the principal soils. Less extensive are other *Chestnut soils* (Farland on loess-mantled areas in the southeast and Lihen in sandy outwash and on terraces throughout), *Solonetz soils*

(Cavour, Cresbard, and Hoven) on gently sloping uplands, and *Humic Gley soils* (Parnell and Lamoure) on some of the wetter flood plains.

54—Rolling Soft Shale Plain

North Dakota and South Dakota
21,700 square miles

Land Use: Nearly all the land is in farms and ranches. In most of the area agriculture is a combination of livestock production and cash-grain farming. About three-fifths of the area is in native grasses and shrubs used for range. The less sloping land, amounting to about one-third of the total area, is dryfarmed. Spring wheat, feed grains, some flax, and hay are the principal crops. Small areas on the bottom land along the Missouri River and a few of its large tributaries are irrigated. Wheat, feed grains, hay, and pasture are the principal crops. Cottonwood and elm trees grow on the narrow bands of wet soils along the large rivers.

Elevation and Topography: 1,800 feet in the east to 3,100 feet in the west. This moderately dissected rolling plain is underlain mainly by calcareous shales and sandstones. Strongly dissected areas of sharp local relief, steep slopes, or badland topography border the major stream valleys in some places. The northern and eastern fringes have glacially modified topography and are covered by thin layers of glacial drift. Maximum local relief is about 300 feet but relief is considerably less in most of the area.

Climate: *Average annual precipitation*—13 to 19 inches, increasing from west to east; highest from late spring to midsummer and very low during the rest of the year; winter precipitation is snow. *Average annual temperature*—40° to 45° F. *Average freeze-free period*—110 to 135 days.

Water: Farming methods that make the most efficient use of moisture are required in this semiarid area. Water for irrigation is available in quantity from only the Missouri River and one or two of its larger tributaries. Water for livestock is stored in small reservoirs in the uplands. Sands and gravels of small areal extent yield moderate amounts of ground water, but ground water is scarce or lacking in parts underlain by shales.

Soil: *Chestnut soils* (Morton) on gentle slopes and *Lithosols* (Bainville and Flasher) on more sloping areas are the major soils. Less extensive are other *Chestnut soils* (Vebar from sandstone and Williams from thin calcareous glacial till). *Solonetz soils* (Rhoades) on very gently undulating plains and terraces and *Alluvial soils* (Havre) on flood plains occupy a small total acreage but are conspicuous locally.

55—Black Glaciated Plains

North Dakota and South Dakota
41,400 square miles

Land Use: Nearly all the area is in farms and ranches, and nearly three-fourths is cropland. Cash-grain wheat production is the principal enterprise on many farms. Other small grains, feed grains, and hay for livestock also occupy moderate acreages. Flax is another important cash crop, and seed potatoes are grown where soils and moisture supplies are favorable. The more sloping thinner soils, amounting to about one-fourth of the area, are in range of native grasses. Narrow bands of wet soils on flood plains are in woodland.

Elevation and Topography: 1,100 to 2,000 feet, increasing from east to west. This nearly level glacial plain is bordered by rolling morainic hills along the western edge. Local relief is low in most of the area, but relief of 50 to 100 feet is typical of the morainic hills.

Climate: *Average annual precipitation*—14 to 20 inches, fluctuating widely from year to year; highest from late spring to early autumn; winter precipitation is snow. *Average annual temperature*—40° to 48° F. *Average freeze-free period*—100 to 145 days, increasing from north to south.

Water: The low and erratic rainfall is the principal source of water for agriculture. Perennial streams are few and widely spaced and are little used for irrigation. Water for livestock is stored in small reservoirs on individual farms or ranches. Ground water is plentiful in glacial drift but the water is hard. The sandstones underlying part of the area yield large amounts of highly mineralized artesian water, but the shales yield very little water.

Soil: *Chernozems* (Barnes, Svea, and Houdek from glacial till and Renshaw, Fordville, and Embden from outwash) are the major soils throughout the area. *Regosols* (Buse on more sloping areas of till and Hecla from outwash) are also fairly extensive. Others are *Solonetz soils* (Cavour and Aberdeen) on nearly level plains throughout the area, *Solonchak soils* (Hamerly) in the northeast, *Humic Gley soils* (Parnell) in wet depressions, and *Gray Wooded soils* (Kelvin and Rolla) in the Turtle Mountains in the north.

56—Red River Valley of the North

North Dakota and Minnesota
15,700 square miles

Land Use: Nearly all the area is in farms and ranches, and about three-fourths is cropland. Important cash crops are spring wheat, potatoes, sugar beets, and corn. Legume seeds are locally important in the northeast. On some farms feed grains and forage for dairy cattle are the principal crops. Nearly 10 percent of the area, mostly the poorer soils in the northeast, is wooded. The more sloping land in the west, amounting to about 10 percent of the area, is in range.

Elevation and Topography: 1,100 feet, decreasing gradually to 800 feet in the north. This nearly level glacial lake plain is bordered on the east by outwash, gravelly beach ridges, and dunes.

Climate: *Average annual precipitation*—19 to 22 inches; highest from late spring to early autumn; winter precipitation is snow. *Average annual temperature*—35° to 42° F., decreasing from south to north. *Average freeze-free period*—105 to 135 days, decreasing from south to north.

Water: Water management is a major problem in the agriculture of this area. In normal years rainfall provides enough moisture for the crops commonly

grown, but the wide fluctuations from year to year make the supply uncertain. Even though rainfall is not high, drainage is required in many of the flatter parts. Drainage systems need to be designed to remove excess water rapidly in the spring so that farming operations can be started as soon as temperatures are favorable.

Soil: *Grumusols* (Fargo) and *Solonchak soils* (Bearden, Glyndon, and Hegne) in medium- to fine-textured lacustrine sediments are the dominant soils. *Humic Gley soils* (Perella, Dimmick, and Tanberg) occupy the wetter parts of the lake plain, *Chernozems* (Embden) the gentle slopes and *Solonchaks* (Ulen) the nearly level slopes of the sandy deltas and lake plains, and *Regosols* (Sioux and Valentine) the gravelly old beach ridges and sand dunes.

57—Western Minnesota Forest-Prairie Transition

Minnesota
3,500 square miles

Land Use: Most of the land is in farms and ranches, but much of one county is an Indian reservation. Cash-grain farming is the principal agricultural enterprise, and livestock production is important. Spring wheat is the major crop; oats, barley, alfalfa, and other hay crops are grown also. The more sloping soils and the wet soils in the east are forested.

Elevation and Topography: 1,000 to 1,100 feet. This glaciated plain is nearly level to gently rolling, but small areas on moraines and outwash terraces have fairly steep slopes. Local relief is commonly in a few feet to a few tens of feet.

Climate: *Average annual precipitation*—22 to 24 inches; highest from midspring to midautumn; winter precipitation is snow. *Average annual temperature*—About 40° F. *Average freeze-free period*—120 to 140 days.

Water: Precipitation is usually adequate for the crops grown, but in the frequent dry years crop yields are reduced. Drainage is necessary for successful crop production on the fine-textured soils of the lowlands. Ground water is abundant but water from deep sources is highly mineralized, especially in the west.

Soil: *Chernozems* (Waukon, Barnes, and Aastad) in calcareous glacial till and *Solonchak soils* in silty deposits are the major soils. *Brunizems* (Wadena and Hubbard) in calcareous outwash and *Gray Wooded soils* (Nebish and Rockwood) in calcareous stony glacial till are other important soils in the east. *Humic Gley soils* (Parnell) are conspicuous locally but of small total extent.

G—WESTERN GREAT PLAINS RANGE AND IRRIGATED REGION

217,600 square miles

In this section of the Great Plains unfavorable soils, strong slopes, or low moisture supplies make success at dryfarming very uncertain. The annual precipitation ranges from 11 to 24 inches but fluctuates widely from year to year. Average annual temperatures are 45° F. in much of the region, but they range from 40° F. in the north to 60° F. in the south. The freeze-free season ranges from 100 days in the north to 200 days in the south.

Chestnut soils are dominant over much of the region, but Brown soils are important in the west. Lithosols on the more sloping parts of the dissected areas, Regosols in sands, and Alluvial soils on flood plains are also extensive. Less extensive, but important locally, are Grumusols in heavy clays and Solonetz soils in depressions and on terraces.

A large part of the region is in range; some wheat is produced by dryfarming methods, mainly along the eastern margin. Irrigation agriculture is practiced along some of the major rivers. Forage and grain for livestock are the principal crops on irrigated land; potatoes, sugar beets, and vegetable crops are important locally.

58—Northern Rolling High Plains

Montana, Wyoming, South Dakota, and North Dakota
66,400 square miles

Land Use: More than four-fifths of the land is in ranches; most of the remainder is owned by the Federal Government. Nearly three-fourths of the area is in native grasses and shrubs grazed by cattle and sheep. Gently sloping deep soils, amounting to 4 or 5 percent of the area, are dryfarmed to wheat. Narrow strips of land along the Yellowstone River and one or two of its tributaries are irrigated. Sugar beets, potatoes, vegetables, alfalfa, other hay crops, and feed grains are the principal crops; some of the land is in tame pasture. The upper slopes and tops of some of the higher buttes are in open woodland of western red cedar.

Elevation and Topography: 3,000 to 6,000 feet, rising gradually from east to west and from north to south. This dissected plain is underlain by shales and sandstones. Slopes are mostly rolling to steep, and wide belts of steeply sloping badlands border a few of the larger river valleys. Local relief is mainly in several tens to a few hundreds of feet. In places flat-topped steep-sided buttes rise sharply above the general level of the plain.

Climate: *Average annual precipitation*—12 to 16 inches, fluctuating widely from year to year; highest in spring and early autumn; winter precipitation is snow. *Average annual temperature*—40° to 45° F. *Average freeze-free period*—120 to 140 days.

Water: The low and erratic rainfall is the principal source of water for agriculture. Water for livestock is stored in small reservoirs but supplies are too small for any significant amount of irrigation. Irrigation water in quantity is available only along the Yellowstone River and one or two of its larger tributaries. Ground water is scarce in most of the area, but locally sand and gravel deposits and coal beds yield small to moderate amounts.

Soil: *Lithosols* (Lismas, Bainville, Midway, and Flasher) are the major soils in much of the area. *Chestnut soils* (Morton, Chama, Vebar, and Regent) in the east and *Brown soils* (Cushman, Renohill, Terry, and Treasure) in the west are on the smoother upland slopes. Locally conspicuous but of small total extent are *Gray Wooded soils* on the higher butte tops and *Solonetz soils* (Rhoades, Winnett, and Arvada) on nearly level to gentle slopes. *Alluvial soils* (Havre, Lohmiller, and Banks) in narrow bands along the major rivers are intensively farmed in many places. About one-eighth of the area is rough broken land or badlands having little or no soil cover.

59—Northern Smooth High Plains

Montana
9,000 square miles

Land Use: Much of the land is in farms and ranches; about one-fifth is owned by the Federal Government. About three-fifths of the area is grazed by cattle and sheep. Most of the grazing land is native range, but small areas are irrigated and in tame pasture. Nearly one-fifth of the area is dryfarmed. Wheat is the main cash crop, and feed grains and hay are also important.

Elevation and Topography: 3,000 to 3,500 feet. The upland divides on these moderately dissected shale plains are fairly broad and the valley walls are steep. The bottom lands in the few stream valleys are narrow. Local relief ranges from a few tens of feet to one or two hundred feet.

Climate: *Average annual precipitation*—12 to 16 inches; highest from late spring to early autumn; winter precipitation is snow. *Average annual temperature*—40° to 42° F. *Average freeze-free period*—120 days.

Water: Agriculture depends almost wholly on the relatively low and erratic rainfall. There are few perennial streams and little water is available for irrigation. Ground water is also scarce.

Soil: *Brown soils* (Cushman and Scobey) are dominant on the gentler slopes with deeper soil cover and

Chestnut soils (Chama) on the moister parts at higher elevations, especially in the east. The most extensive soils are *Lithosols* (Bainville and Flasher) on hilly and steep slopes. *Regosols* (Zahl) occur in small areas of glacial till in the east and *Solonetz soils* (Winnett and Gilt Edge) on nearly level to gentle slopes throughout.

60—Pierre Shale Plains and Badlands

South Dakota, Wyoming, and Montana
13,500 square miles

Land Use: Much of the land is in farms and ranches, and about one-fifth is owned by the Federal Government. Nearly three-fourths of the area is in range of native grasses and shrubs grazed by cattle and sheep. Many ranches have small areas of irrigated or tame pasture. Between 5 and 10 percent of the land, mostly gently sloping deep soils in the east, is dryfarmed. Wheat is the main cash crop, but feed grains and hay are grown as well.

Elevation and Topography: 2,500 to 5,000 feet, increasing from east to west. This dissected shale plain has undulating to gently rolling narrow divides and hilly to steep valley walls. Bands of badland topography border most of the larger stream valleys. Local relief is in several tens to a few hundreds of feet.

Climate: *Average annual precipitation*—11 to 16 inches; highest from midspring to early autumn; winter precipitation is snow. *Average annual temperature*—About 45° F. *Average freeze-free period*—115 to 140 days.

Water: Water is scarce throughout the area. The low rainfall limits agriculture to grazing. Ground water is scarce and of poor quality.

Soil: *Chestnut soils* (Pierre and Rosebud) are the major soils on gentle slopes, but *Lithosols* (Lismas and Midway) on steeper slopes are more extensive. Large areas of badlands or of rough broken land having little or no soil cover border some of the valleys. *Solonetz soils* (Rhoades and Arvada) occupy level to gentle slopes and *Brown soils* (Cushman, Renohill, and Briggsdale) gentle slopes in the driest parts in the west.

61—Black Hills Foot Slopes

South Dakota and Wyoming
5,200 square miles

Land Use: Two-thirds or more of the area is in farms, ranches, or other private holdings; the remainder is owned by the Federal Government. Half or more of the area is in range of native grasses or shrubs grazed by cattle and sheep. The higher hills, amounting to less than 10 percent of the area, are in open woodland that has a grass ground cover. This woodland produces some timber and is also used for grazing. Between 5 and 10 percent of the area is dryfarmed, and small areas in some valleys are irrigated.

Elevation and Topography: 2,700 feet to more than 5,000 feet. Slopes of these dissected mountain foothills are mostly hilly to steep, but on the narrow ridgetops and in the narrow valleys slopes are gentle. The area is crossed by many streams flowing out of the Black Hills in a radial pattern. Local relief is in several tens of feet to a few hundreds of feet.

Climate: *Average annual precipitation*—16 to 18 inches; highest from midspring to early autumn; winter precipitation is snow. *Average annual temperature*—About 45° F. *Average freeze-free period*—115 to 140 days.

Water: The area depends mainly on the relatively low rainfall for water. Streamflow provides water for livestock and reservoirs on a few of the major rivers water for irrigation. Ground water is scarce and of poor quality.

Soil: Detailed information is lacking for much of the area. *Chestnut soils* (Pierre, Promise, Grail, Vale, and Fergus) are the principal soils. *Lithosols* (Lismas and Spearfish) occupy the steep slopes bordering many of the valleys and rough stony land, some of the steeper slopes.

62—Black Hills

South Dakota and Wyoming
2,200 square miles

Land Use: Most of the area is in forest used for recreation and timber production. Small areas of open woodland having a grass ground cover provide a small amount of grazing.

Elevation and Topography: 4,000 feet to more than 7,000 feet. The central mountain core of metamorphic and igneous rocks is surrounded by a dissected plateau that is mostly limestone. Slopes are mainly steep and hilly but those of the plateau remnants are rolling. The radial drainage is considered a classic example of this pattern. Local relief is in several hundreds of feet.

Climate: *Average annual precipitation*—16 to 24 inches; highest from midspring to early autumn. *Average annual temperature*—40° to 45° F. *Average freeze-free period*—100 to 120 days.

Water: The moderate rainfall is the principal source of water. Some of the larger perennial streams provide water for livestock and for recreation. Ground water is scarce.

Soil: Detailed information is lacking. Rough stony land and *Lithosols* (Spearfish and Laporte) are dominant on the more rugged mountain slopes and *Gray Wooded soils* (Edloe) on forested slopes. *Chernozems* and *Chestnut soils* are the principal soils on the lower slopes in open woods.

63—Rolling Pierre Shale Plains

South Dakota and Nebraska
13,700 square miles

Land Use: Most of the area is in farms and ranches but between 5 and 10 percent is owned by the Federal Government. About three-fourths of the area is in native range grazed by cattle and sheep. About one-fifth of the land is dryfarmed. Winter wheat is the main crop; feed grains and forage for livestock are grown also.

Elevation and Topography: 1,800 to 3,000 feet, rising gradually from east to west. Ridgetops on this dissected shale and clay plain are undulating and relatively narrow; side slopes are hilly to steep. The

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steep-walled valleys have very narrow flood plains. Local relief ranges from several tens of feet to one or two hundred feet or more.

Climate: *Average annual precipitation*—15 to 20 inches; highest from midspring to midautumn; winter precipitation is low and falls as snow. *Average annual temperature*—40° to 50° F. *Average freeze-free period*—140 to 160 days.

Water: The area depends almost entirely on the relatively low and somewhat erratic rainfall. The few perennial streams have very wide seasonal fluctuations in flow. Ground water is scarce and of poor quality.

Soil: Chestnut soils (Pierre and Promise) are most extensive but there are some *Chernozems* (Boyd) on moister sites and *Lithosols* (Lismas) on the more sloping parts.

64—Mixed Sandy and Silty Tableland

South Dakota and Nebraska
5,700 square miles

Land Use: Nearly all the land is in farms and ranches. About one-half of the area is in native grasses grazed by cattle and sheep. Nearly one-third is cropland. In the southwest cash-grain farming, principally winter wheat, is the major enterprise; elsewhere feed and forage for livestock are the main crops.

Elevation and Topography: 3,000 to 4,000 feet, increasing gradually from east to west. This level to gently sloping tableland is cut by narrow steep-walled valleys. Along the southern edge, deep sands have irregular rolling to hilly dune topography. Local relief is mainly in a few feet to a few tens of feet but is greater along the valleys.

Climate: *Average annual precipitation*—15 to 18 inches; highest in the freeze-free period; winter precipitation is snow. *Average annual temperature*—45° to 48° F. *Average freeze-free period*—About 140 days.

Water: Most of the area depends on the rather low and erratic rainfall for water. Ground water is scarce and of poor quality in most of the area; locally sands and gravels yield moderate to large amounts of good water.

Soil: *Chestnut soils* (Keith, Rosebud, and Anselmo) from silty or fine sandy materials are dominant. Bands of *Lithosols* (Epping and Canyon), rough broken land, and badlands border the major drainageways. *Regosols* (Valentine) in deep sands and *Alluvial soils* (Havre) on flood plains are locally conspicuous but of small total extent.

65—Nebraska Sand Hills

Nebraska
20,000 square miles

Land Use: Nearly all the land is in large ranches, and most of it is in native grass grazed by livestock. Small areas along the streams are used to grow hay and other feed crops.

Elevation and Topography: 2,000 to 4,000 feet, rising gradually from east to west. Most of the area consists of stabilized old sand dunes having rolling to steep irregular slopes. There are many scattered small level depressions. Streams are few, but there are many ponds, small lakes, and marshes in the deeper depressions. Local relief is in several tens of feet to about 150 feet.

Climate: *Average annual precipitation*—17 to 23 inches; about three-fourths falls from midspring to midautumn; winter precipitation is snow. *Average annual temperature*—47° to 50° F. *Average freeze-free period*—140 to 160 days.

Water: Rangeland depends on rainfall for water. The many small lakes and ponds provide water for livestock. Ground water is abundant and of good quality; it meets domestic requirements and part of the livestock and other needs.

Soil: Stabilized dunes that have little evidence of soil formation except a slight darkening of the upper 2 or 3 inches occupy nearly one-third of the area. Much of the remaining area consists of *Regosols* (Valentine) that have a thicker and darker surface layer. *Humic Gley soils* (Gannett and Loup) are in depressions among the dunes and along flood plains of the larger streams.

66—Dakota-Nebraska Eroded Tableland

South Dakota and Nebraska
4,700 square miles

Land Use: Nearly all the land is in farms and ranches, and more than three-fourths of it is in range of native grasses. Beef cattle are the principal livestock, but sheep are raised in the west. Between 10 and 20 percent of the area is cropland. Forage and feed grains are the major crops, and some wheat is grown for sale.

Elevation and Topography: 2,000 to 3,000 feet, increasing gradually from east to west. These undulating to rolling uplands are underlain by calcareous sandstones. Steep slopes border the valleys of most streams. Local relief is from a few tens of feet to 100 feet or more.

Climate: *Average annual precipitation*—18 to 24 inches; highest from midspring to midautumn; winter precipitation is snow. *Average annual temperature*—47° to 50° F. *Average freeze-free period*—140 to 160 days.

Water: Crops and range depend mainly on rainfall for water. Ground water is scarce and of poor quality. But along the southern fringe, windblown sands yield an abundance of ground water and the high water table supplies moisture for crops. In these areas wells supply water for livestock.

Soil: Sandy and silty *Chernozems* (Holt and Moody) occupy most of the gentle slopes and clayey *Chernozems* (Boyd) the rolling hills. *Brunizems* (Thurman) are in sandy areas with better moisture supplies and *Regosols* (Valentine) on the more sloping sandy areas.

67—Central High Plains

Wyoming, Colorado, and Nebraska
33,100 square miles

Land Use: Nearly all the land is in farms and ranches. About three-fifths is in range of native short and mid

grasses grazed by cattle and sheep. About one-fourth of the area is dryfarmed. Wheat is the major crop; sorghum, broomcorn, dry beans, corn, feed grains, and hay are grown on large acreages. About 5 percent of the area is irrigated. Corn, alfalfa, sugar beets, and vegetables are the major irrigated crops. Wet areas on flood plains are in meadows used for hay or pasture.

Elevation and Topography: 3,500 to 6,000 feet, increasing gradually from east to west. These undulating to rolling plains have been moderately dissected by streams. Steep slopes border the valleys of the larger streams and also the edges of isolated mesas. The dunes bordering some of the valleys have rolling to hilly irregular topography. Local relief is mainly in a few tens of feet to 100 or 200 feet.

Climate: *Average annual precipitation*—13 to 17 inches; highest in midspring and late autumn. *Average annual temperature*—45° to 50° F. in most of the area, increasing to 55° F. in the extreme south. *Average freeze-free period*—120 to 160 days in most of the area but as long as 180 days in the extreme south.

Water: Rangeland and cropland depend largely on the low and erratic rainfall for water. Over much of the area sands and gravels yield adequate supplies of ground water for livestock and for domestic and other uses. Where shale bedrock is near the surface, ground water is scarce and commonly of poor quality. Irrigation water is obtained mostly from the larger rivers; locally wells provide some irrigation water.

Soil: *Brown soils* (Stoneham, Baca, Vona, and Fort Collins) are dominant on smooth slopes over most of the area and *Chestnut soils* (Rosebud, Altvan, Weld, Platner, and Keith) on smooth slopes where moisture supplies are more favorable, mainly in the north and east. *Lithosols* (Canyon, Epping, Lismas, and Midway) are dominant on steep slopes bordering stream valleys and along the edges of mesas. *Regosols* (Dwyer, Valentine, and Colby) are in deep sands and silts with hilly to steep topography and *Alluvial soils* (Bridgeport, Lohmiller, Havre, and Banks) on narrow flood plains of the larger streams.

68—Irrigated Upper Platte River Valley

Colorado
3,000 square miles

Land Use: Most of the land is in farms and ranches, but more and more areas near Denver and other cities along the western edge are being diverted to urban use. More than half of the area is cropped. Corn, sugar beets, potatoes, melons, and vegetables for canning are grown under intensive management on much of the irrigated land, but a large acreage is in grass, hay, and pasture. Unirrigated cropland is dryfarmed to wheat and other grains. The more sloping and shallow soils, amounting to one-third or more of the area, are in grass and brush used for grazing.

Elevation and Topography: 4,500 to 5,300 feet, increasing gradually from east to west. Several broad valleys cross this undulating to gently rolling silt- and outwash-mantled plain. Steep slopes are confined to relatively narrow bands along a few large valleys. Local relief is mainly in a few tens of feet.

Climate: *Average annual precipitation*—13 to 15 inches, fluctuating widely from year to year. *Average annual temperature*—45° F. *Average freeze-free period*—120 to 160 days.

Water: Water for irrigation is obtained mainly from the South Platte River and a few of its larger tributaries but the supply is supplemented by water diverted from the western slopes of the Rockies. Dryfarming areas depend on the low and erratic rainfall. Ground water is abundant in deep sands and gravels and is adequate for domestic, livestock, and municipal use and for some irrigation. Where shale bedrock is near the surface, ground water is scarce and of poor quality.

Soil: *Brown soils* (Fort Collins, Terry, and Greeley) and *Chestnut soils* (Weld, Platner, and Nunn) are the principal soils on the smooth silt-mantled uplands, fans, and terraces and *Lithosols* (Lismas) on the more sloping areas. *Alluvial soils* (Havre, Las, and Wann) on flood plains and younger fans are among the more important soils for crops. *Regosols* (Valentine and Colby) are in deposits of windblown sands and silts on steep slopes.

69—Upper Arkansas Valley Rolling Plains

Colorado
12,200 square miles

Land Use: Nearly all the land is in farms and ranches. Almost three-fourths of the area is in native short grasses used for grazing. Flood plains and terraces along the Arkansas River, 5 to 10 percent of the area, are irrigated. Alfalfa, sugar beets, grain sorghum, melons, seed crops, corn, small grains, onions, and other vegetables are the more extensive crops. Land that is flooded frequently and soils that are strongly affected by salts are used for grazing. Between 5 and 10 percent of the area is dryfarmed. Winter wheat, dry beans, and grain sorghum are the main crops.

Elevation and Topography: 3,500 to 6,200 feet, increasing gradually from east to west. These undulating to rolling shale plains are mantled by loess or windblown sand, alluvium, and outwash in many places. Wide bands of steep slopes border several of the larger tributaries of the Arkansas River. Local relief is mostly less than 50 feet but is as much as one or two hundred feet in some of the rougher parts.

Climate: *Average annual precipitation*—10 to 15 inches; fluctuates widely from year to year; highest from midspring through late autumn. *Average annual temperature*—About 50° F. *Average freeze-free period*—140 to 160 days.

Water: Rangeland depends on the low and erratic rainfall. The Arkansas River and one or two of its larger tributaries provide water for irrigation along their valleys. Ground water in the deeper sands and gravels provides water for livestock and domestic and other uses over much of the area and locally some water for irrigation. Ground water is scarce in the large areas where shale bedrock is near the surface.

Soil: *Regosols* (Minnequa and Manvel) are the dominant soils on the silt-mantled uplands and terraces and *Brown soils* (Vona and Baca) in areas where precipitation is slightly higher. Other *Regosols* (Tivoli and Dwyer) occupy the sloping to rolling sandy areas and *Alluvial soils* (Las Animas and Havre) the flood plains, terraces, and younger alluvial fans; these *Alluvial soils* are affected by salts in many places. *Lithosols* (Penrose, Travessilla, and Lismas) and rough broken land occur on the fairly wide bands of steep slopes bordering the valleys of several tributaries of the Arkansas River.

70—Pecos-Canadian Plains and Valleys

New Mexico and Colorado
28,900 square miles

Land Use: Most of the land is in farms, ranches, or other private holdings; about 10 percent is owned by the Federal Government. More than three-fourths of the area is in range, and cattle and sheep grazing is the principal enterprise. Range at lower elevations consists of short and mid grasses and brush and at higher elevations of open pinyon-juniper woodland that has a grass understory. Some of the northern and eastern slopes of the high mesas in the north are covered by forest, but the total forested area is small. About 3 percent of the area is cropland. Where moisture supplies are more favorable, mainly in the west and north, the deeper soils are dryfarmed. Beans, small grains, and grain sorghum are the principal crops; some hay is grown and some land is in pasture. Small tracts in some of the valleys and on the uplands are irrigated, partly from wells and partly from reservoirs. Sugar beets, forage, and feed grains are the principal crops.

Elevation and Topography: 4,000 to 6,500 feet, increasing gradually from southeast to northwest, a few mesas and mountains 8,000 feet or more. Most of the slopes of this dissected high plain are gentle to rolling, but bands of steep slopes and rough broken land border the stream valleys. A few isolated mountains, mesas, and canyon walls have steep to very steep slopes. Valley floors are mostly narrow and much cut by stream channels. Local relief is mainly in a few tens of feet but is as much as several hundred feet in some of the rougher parts.

Climate: *Average annual precipitation*—12 to 16 inches, fluctuating widely from year to year; highest from late spring to late autumn. *Average annual temperature*—50° to 60° F. *Average freeze-free period*—160 to 200 days, decreasing from southeast to northwest.

Water: Because of the low and erratic rainfall and the few perennial streams, water is scarce throughout the area. Ground water in deep sands and gravels in the north and from limestone in the southern two-thirds of the area provides water for domestic use and livestock and locally for irrigation. Where shale and sandstone are near the surface, ground water is scarce.

Soil: Shallow soils and soils having weakly expressed profiles are widespread—*Lithosols* (Apache, Penrose, Potter, Laporte, and Travessilla), rough broken land, and rockland on gentle to moderate slopes of uplands, and *Regosols* (Tivoli and Preston) in deep sands. *Reddish-Brown soils* (Carnero, Witt, and Alamo) are on the smoother uplands throughout most of the area, but *Reddish Chestnut soils* and *Chestnut soils* (La Brier and Paiso) are in the deeper materials in the north. *Calcisols* (Quay and Harvey) are of small total extent but are important locally.

H—CENTRAL GREAT PLAINS WINTER WHEAT AND RANGE REGION

219,900 square miles

Soils, topography, and climate are more favorable for agriculture in this region than in the Great Plains to the north and west. The longer freeze-free season permits a greater variety of crops to be grown than in the northern Great Plains. The average annual precipitation is 20 to 30 inches over much of the region but ranges from 15 to 35 inches, increasing from northwest to southeast. More rain falls during summer than in the rest of the year. Average annual temperatures are 50° to 65° F., increasing from north to south. The freeze-free season is 170 to 180 days in most of the region but ranges from 150 to 240 days, increasing in length from north to south.

The important soils in the north are in the Chernozem and Chestnut groups. Reddish Prairie soils and Reddish Chestnut soils are extensive in the south. Lithosols on steep slopes, Regosols in deep sands, and Alluvial soils on flood plains are common throughout the region.

Cash-grain farming with wheat as the principal crop is the major agricultural enterprise on most of the better soils. Grain sorghum is grown in many of the drier areas. In the south where the freeze-free period exceeds 200 days, cotton is grown extensively under irrigation from wells. The steeply sloping shallow and sandy soils are used for range.

71—Central Nebraska Loess Hills

Nebraska
8,000 square miles

Land Use: Nearly all the land is in farms and ranches and almost two-fifths of it is dryfarmed. Winter wheat is the major cash crop, but corn, grain sorghum, other feed grains, and hay occupy large acreages. Between 5 and 10 percent of the total area, consisting of flood plains and terraces along the Platte River and its larger tributaries, is irrigated. Corn and forage are the principal crops, and some sugar beets, seed crops, and potatoes are grown. About one-half of the area is in native grasses used for grazing.

Elevation and Topography: 1,500 to 2,500 feet, increasing from east to west. Undulating to gently rolling loess-mantled narrow ridgetops are separated by steep slopes bordering drainageways. The large streams have wide level flood plains and adjoining terraces. Local relief is in several tens of feet to one or two hundred feet.

Climate: *Average annual precipitation*—20 to 25 inches; highest from spring through autumn with the maximum in late spring to early summer. *Average annual temperature*—About 50° F. *Average freeze-free period*—150 to 160 days, increasing from west to east.

Water: Over most of the area both crops and pasture depend on the low and erratic rainfall. The larger rivers provide water for irrigation along their valleys. Over much of the area ground water is abundant and of good quality; it meets domestic and livestock needs and is used locally for irrigation.

Soil: *Chernozems* (Holdrege, Hastings, Hall, and Hord) are dominant on gentle slopes of uplands and terraces and *Regosols* (Colby) on steep slopes. *Solonetz soils* (Exline) occupy small nearly level areas on terraces; their total area is small but they are conspicuous and affect the use and management of adjacent soils.

72—Central High Tableland

Kansas, Nebraska, and Colorado
33,900 square miles

Land Use: Nearly all the land is in farms and ranches and three-fifths or more is cropland. This is a major dryfarming area. Winter wheat is the main cash crop, but other small grains, grain sorghum, some corn, and alfalfa and other hay crops occupy large acreages. Many kinds of crops are grown on the narrow bands of irrigated land along the Platte, Republican, and Arkansas Rivers. One-third or more of the area, consisting of hilly and steep slopes bordering drainageways, is in native grasses and shrubs used for grazing.

Elevation and Topography: 2,000 to 4,000 feet, increasing from east to west. On this smooth loess-mantled tableland slopes are mostly undulating to gently rolling, but the major valleys are bordered by steep slopes. The Arkansas and Platte Rivers and a few of their larger tributaries have broad level flood plains and terraces. Local relief in the uplands is in a few feet to a few tens of feet, but valleys are 100 feet or more below the general level of the upland.

Climate: *Average annual precipitation*—16 to 21 inches, fluctuating widely from year to year; highest from late spring through early autumn; winter precipitation is snow. *Average annual temperature*—50° to 57° F. *Average freeze-free period*—170 to 185 days, increasing from northwest to southeast.

Water: Crops and pastures on uplands depend on the low and erratic rainfall. Irrigation water obtained from the Arkansas, Republican, and Platte Rivers is

used along their valleys. Over most of the area ground water of good quality is adequate for domestic and livestock needs and is used locally for irrigation. Where shales are near the surface, ground water is scarce.

Soil: *Chestnut soils* (Keith, Rosebud, Richfield, and Anselmo) on the smoother loess-mantled uplands and terraces occupy half or more of the area. *Regosols* (Colby on steep loess-mantled slopes and Tivoli and Valentine in deep sands) are also important. *Lithosols* (Canyon and Potter) are on steep slopes bordering the large streams.

73—Rolling Plains and Breaks

Kansas and Nebraska
17,700 square miles

Land Use: Nearly all the area is in farms and about three-fifths is dryfarmed cropland. Winter wheat and grain sorghum are the major crops over much of the area, and corn is important in the north. Feed grains and hay are other major crops. About 2 percent of the area, mostly in narrow bands of bottom land and terraces along the Republican and Platte Rivers and their major tributaries, is irrigated. Corn, alfalfa, small grains, and hay occupy much of the irrigated land, and some potatoes and vegetables are grown. One-third or more of the area is in native grasses used for grazing.

Elevation and Topography: 1,500 to 3,000 feet, increasing from east to west. These dissected plains have broad undulating to rolling ridgetops and hilly to steeply sloping valley sides. Valleys are generally narrow, but the Republican River and its larger tributaries have broad flood plains and terraces. Local relief is in a few tens of feet to one or two hundred feet.

Climate: *Average annual precipitation*—20 to 25 inches; highest from midspring to early autumn; winter precipitation is snow. *Average annual temperature*—50° to 55° F. *Average freeze-free period*—150 to 180 days, increasing from northwest to southeast.

Water: In most of the area crops and pastures depend on the moderate and erratic rainfall. The Republican and Platte Rivers and their larger tributaries provide water for irrigation along their valleys. Abundant ground water for irrigation and other uses is obtained from deep wells in the north, but ground water is scarce in the south where shale and limestone are near the surface.

Soil: *Chernozems* (Holdrege, Hastings, and Crete) in moderate to deep loess cover much of the area. *Regosols* (Colby) are on the steep slopes bordering many of the valleys and *Alluvial soils* (Humbarger, Carr, Hobbs, and Leshara) on flood plains of the larger streams.

74—Central Kansas Sandstone Hills

Kansas
4,700 square miles

Land Use: Most of the land is in farms and more than one-half is cropland. Winter wheat is the principal crop; grain sorghum, hay, small grains, and corn are other important crops. Recently some land along the large rivers has been irrigated. Crops are about the same as in the unirrigated areas although more corn is grown and less wheat. About one-third of the area is in range of native grasses grazed by cattle.

Elevation and Topography: 1,300 to 1,800 feet, increasing from east to west. Local relief on this undulating to hilly dissected plain is in several tens of feet to a few hundred feet. The larger rivers have wide flood plains and terraces, but the small streams have narrow bottom lands.

Climate: *Average annual precipitation*—25 to 28 inches; highest from spring through autumn with the maximum in midsummer. *Average annual temperature*—54° to 56° F. *Average freeze-free period*—170 to 180 days.

Water: The moderate rainfall is generally adequate for crops and pasture if moisture is carefully conserved. The larger streams can supply water for irrigation but most of them have not been so used. Ground-water supplies meet domestic and livestock needs in most of the area and are used locally for irrigation. In the areas in the east where shales are near the surface, ground water is scarce.

Soil: *Brunizems* (Lancaster) are the dominant soils on gentle slopes of the sandsone uplands and *Lithosols* (Hedville and Cloud) on hilly and steep slopes of ridges and valley sides. *Chernozems* (Ebenezer and Berg) are on silt-mantled ridgetops and foot slopes, mainly in the east, and *Alluvial soils* (Hobbs and Humbarger) on flood plains of the larger rivers.

75—Central Loess Plains

Nebraska and Kansas
13,700 square miles

Land Use: Nearly all the land is in farms and about two-thirds is cropland. Hard winter wheat and grain sorghum are the main cash crops but other small grains and hay occupy large acreages. Corn is a major crop in the north. Corn and other feed grains are grown on a narrow band of irrigated land along the Platte River in the northwest. About one-fourth of the land is in range or pasture grazed by beef cattle.

Elevation and Topography: 1,500 to 2,000 feet, increasing from east to west. This nearly level to gently rolling plain is mantled by loess except in the part south of central Kansas, which is underlain by unconsolidated sediments and soft sandstones and shales. Stream valleys are mostly narrow and are not deeply incised. Relief is in a few feet to a few tens of feet.

Climate: *Average annual precipitation*—25 to 30 inches; highest from midspring to midautumn; the low winter precipitation is snow. *Average annual temperature*—50° to 58° F., increasing from north to south. *Average freeze-free period*—160 to 190 days.

Water: Grain crops and pasture depend on the moderate but somewhat erratic rainfall for moisture. In the northwest, the Platte River furnishes some water

for irrigation. Ground water that is hard but otherwise of good quality is abundant in the sands and gravels underlying much of the area. Where shales and clays are near the surface, ground water is scarce.

Soil: *Chernozems* (Crete, Hastings, Nuckolls, and Kipp) are dominant on gentle to rolling slopes of the loess-mantled uplands and terraces; *Planosols* (Butler, Goessel, and Fillmore) are on the associated level areas. In the south *Brunizems* (Irwin and Ladysmith) are on nearly level and gently sloping uplands. *Regosols* (Colby) are on strongly sloping valley sides and *Alluvial soils* (Humbarger, Hobbs, Carr, and Volin) on flood plains.

76—Bluestem Hills

Kansas and Oklahoma
10,200 square miles

Land Use: Nearly all the land is in farms and ranches and about three-fifths is in native grasses grazed by beef cattle. Nearly one-fifth of the area, mainly the deeper soils in valleys and on some of the uplands, is cropland. Although some winter wheat is grown as a cash crop, other small grains, grain sorghum, alfalfa, and other hay are the major crops. The same crops are grown on small irrigated areas along the Arkansas River.

Elevation and Topography: 1,000 to 1,500 feet. These dissected limestone and shale uplands have narrow divides and narrow steep-sided valleys. Only a few large streams have any significant area of flood plains. Local relief is commonly in several tens of feet to two or three hundred feet.

Climate: *Average annual precipitation*—30 to 35 inches; highest from midspring through early autumn. *Average annual temperature*—54° to 60° F. *Average freeze-free period*—Mainly 170 to 190 days but slightly more than 200 days in the south.

Water: The moderate rainfall provides water for pastures and crops. Much of the water for livestock is stored in small reservoirs and ponds. Shallow wells yield moderate amounts of good-quality water in the limestone areas but very little in areas underlain by shales. Water from deep wells is highly mineralized.

Soil: *Lithosols* (Sogn) are very extensive. *Brunizems* (Florence, Summit, Irwin, and Ladysmith) and *Planosols* (Dwight) are in the more deeply weathered clays, shales, and limestones of nearly level and gently sloping uplands. *Alluvial soils* (Osage) are on flood plains of the larger streams.

77—Southern High Plains

Texas, New Mexico, Oklahoma, and Kansas
50,300 square miles

Land Use: Almost all the land is in farms and ranches. More than two-fifths of the area, consisting of breaks along the Canadian and Cimarron Rivers and their larger tributaries and areas of sandy soils in the southwest, is in range of native grasses and shrubs grazed by beef cattle. About one-third of the area, the smooth uplands, is dryfarmed to winter wheat and grain sorghum. Nearly one-fifth of the area, mostly south of the Canadian River, is irrigated. Cotton and grain sorghum are the major crops.

Elevation and Topography: 2,500 to 5,000 feet, increasing gradually from east to west. These smooth high plains have gentle slopes except for the very steeply sloping breaks along the major rivers. The deep sands in the southwest have irregular dune topography. Local relief is in a few feet to a few tens of feet, but the major valleys are one to several hundred feet below the general level.

Climate: *Average annual precipitation*—15 to 23 inches; fluctuates widely from year to year; highest from late spring through autumn; the low winter precipitation is mainly snow. *Average annual temperature*—55° to 60° F. *Average freeze-free period*—180 to 220 days, increasing from north to south and from west to east.

Water: Dryfarmed crops and range depend on the moderately low and erratic rainfall. Perennial streams are few; they fluctuate widely in flow from year to year and have been little used for irrigation. Sands and gravels throughout the area yield an abundance of ground water. Irrigation water is obtained from wells in the southern part, but withdrawals now exceed recharge and the water table is being gradually lowered.

Soil: *Chestnut soils* and *Reddish Chestnut soils* (Amarillo, Dalhart, Olton, and Pullman) in loamy mantles are the principal soils of the uplands. *Calcisols* (Mansker and Portales) are dominant on the more sloping parts and in shallow valleys, *Lithosols* (Canyon, Kimbrough, Potter, and Travessilla) on the steeper slopes and breaks, and *Regosols* (Tivoli) and *Reddish-Brown soils* (Brownfield) in the deep sands in the southwest.

78—Central Rolling Red Plains

Texas, Oklahoma, and Kansas
51,800 square miles

Land Use: Nearly all the land is in farms and ranches. About half the area, mainly the more sloping parts, is in range or pasture of native grasses grazed by beef cattle. The largest areas of range are in the west but there is some throughout the area. The smooth uplands, nearly two-fifths of the area, are cropped. Winter wheat is the major crop throughout the area; cotton is also important south of the Cimarron River. Grain sorghum and alfalfa occupy large acreages, and sweet potatoes and peanuts are important locally on some of the sandy soils. The same crops are grown on the small irrigated areas south of the Red River and in southwestern Oklahoma.

Elevation and Topography: 1,500 to 3,000 feet, increasing gradually from east to west. On this dissected plain, the broad divides are nearly level to gently sloping and the valleys have short but steep slopes. In places the valleys are bordered by rolling to steep irregular dune topography. Local relief is mainly in only a few tens of feet, but a few of the larger valleys are 100 feet or more below the general level of the plain.

Climate: *Average annual precipitation*—20 to 30 inches; highest from late spring through autumn.

Average annual temperature—57° to 65° F. *Average freeze-free period*—185 to 230 days.

Water: Over most of the area both crops and range depend on the moderate but somewhat erratic rainfall. The larger rivers are potential sources of water for irrigation but are very little used at present. The deep sands and gravels in valleys yield some ground water. In areas of deep soils on uplands, shallow wells provide water for domestic and livestock needs. In the sloping areas where the underlying sandstones and shales are near the surface, ground water is scarce.

Soil: *Reddish Chestnut soils* and *Chestnut soils* (Tillman, Foard, Mansic, Carey, Miles, and Abilene) occupy most of the smoother uplands except those in the northeast on which *Reddish Prairie soils* (Albion and Grant) occur. In about one-half of the area, consisting of the more sloping parts, the soils are thin or have weakly expressed profiles—*Regosols* (Quinlan, Tivoli, and Enterprise) in deep sandy materials, *Lithosols* (Vernon and Potter) on slopes underlain by consolidated rocks, and *Calcisols* (Mansker) in areas with a strong caliche horizon. Less extensive but locally important are *Alluvial soils* (Yahola and Miller) on flood plains.

79—Great Bend Sand Plains

Kansas
4,200 square miles

Land Use: Nearly all the land is in farms and ranches and more than two-thirds is cropland. Cash-grain farming is the principal enterprise. Hard winter wheat is the major crop, and grain sorghum and alfalfa are grown also. About one-fifth of the area, consisting of sandy soils and steeply sloping areas, is in range of native grasses grazed by beef cattle.

Elevation and Topography: 1,500 to 2,500 feet. These undulating to rolling plains have a deep mantle of windblown sand and sandy outwash materials. Local relief is mainly in a few tens of feet.

Climate: *Average annual precipitation*—21 to 28 inches; highest from late spring through early autumn. *Average annual temperature*—55° to 57° F. *Average freeze-free period*—180 to 190 days.

Water: Crops and pasture depend on the moderate but somewhat erratic rainfall. Along the northern edge, the Arkansas River is a potential source of irrigation water but is little used at present. Deep sands yield an abundance of good ground water for domestic use, livestock, and other uses.

Soil: *Reddish Chestnut soils* (Pratt) and *Brunizems* (Shellabarger and Farnum) occupy the gentle slopes. *Regosols* (Tivoli) are on areas of dunelike topography and *Alluvial soils* (Wann, Leshara, and Canadian) on flood plains of the Arkansas River.

80—Central Rolling Red Prairies

Texas, Oklahoma, and Kansas
25,400 square miles

Land Use: Nearly all the land is in farms and ranches. Slightly less than one-half of the area is cropland, and only a few small areas are irrigated. The proportion of cropland is somewhat less and that of range somewhat higher in the southern third of the area. Winter wheat is the main cash crop; cotton and some truck crops are grown in southern Oklahoma and northern Texas. Other crops are small grains, grain sorghum, alfalfa, and hay. A little more than two-fifths of the area is in range or pasture of native grasses and shrubs. Beef cattle are the principal livestock, and locally there are some dairy cattle.

Elevation and Topography: 1,000 to 1,500 feet. On this dissected plain the divides are undulating to gently rolling and the valley sides hilly and steep. Flood plains of large streams are wide and level and much less cut by stream channels than those in areas to the west. Local relief is mainly in a few feet to several tens of feet.

Climate: *Average annual precipitation*—23 to 35 inches; highest in spring and summer and lowest in midwinter. *Average annual temperature*—57° to 65° F. *Average freeze-free period*—190 to 240 days.

Water: Crops and pastures depend on the moderate but somewhat erratic rainfall. Several large rivers that cross the area from west to east are potential sources of irrigation water but are not much used at present. Shallow wells provide moderate amounts of water for domestic use and for livestock in areas of deep soils, but ground water is scarce where the underlying shales and sandstones are close to the surface. Ground water from deep wells is generally highly mineralized.

Soil: *Reddish Prairie soils* (Renfrow, Grant, Kirkland, and Zaneis) occupy the smoother upland slopes in most of the area but *Reddish Chestnut soils* (Pond Creek and Pratt) are most extensive on those in the southwest and *Chernozems* (Idana) on those in Kansas and northern Oklahoma. *Lithosols* (Lucien, Vernon, and Kipson) are dominant on steep slopes and *Regosols* (Tivoli) in deep sands. *Alluvial soils* (Yahola, Gowen, Port, and Reinach) are on flood plains and low terraces along the larger streams.

I—SOUTHWESTERN PLATEAUS AND PLAINS RANGE AND COTTON REGION

68,000 square miles

This region consists of the warmer part of the southern Great Plains. The moderate precipitation is accompanied by high temperatures so that precipitation effectiveness is low. The average annual precipitation is 20 to 30 inches over most of the region but it ranges from 15 to 35 inches; usually much of it falls in spring and autumn. Average annual temperatures are 60° to 70°F., and the freeze-free season ranges from 220 to 320 days, increasing in length from north to south.

The soils in the deeper coarse- and medium-textured materials are mostly in the Reddish Chestnut and Reddish Prairie great soil groups. Grumusols from limestones and marls and Lithosols and Calcisols in all kinds of parent material on hilly to steep slopes are also fairly extensive.

Range is the dominant land use over most of the region, but some wheat, other small grains, and grain sorghum are grown where soils, topography, and moisture supplies are favorable. In the southeast, cotton grown under irrigation is important. Citrus fruits and winter vegetables are grown along the lower Rio Grande Valley.

81—Edwards Plateau

Texas
33,100 square miles

Land Use: Nearly all the land is in farms and ranches. About four-fifths is in range grazed by beef cattle, sheep, and goats. In the west the cover consists of short grasses and shrubs; in the east the range is open woodland of scrub oak and cedar that has a grass ground cover. Deciduous forests grow on steep valley walls and on flood plains in the east and south. Only 1 or 2 percent of the area, the smoother uplands and the valleys in the east, is cropland. Winter wheat, grain sorghum, and hay are the main crops and there is some pasture. There are many pecan orchards on flood plains in the east, and cotton is grown in a small area in the north. Small areas along the San Saba River are irrigated.

Elevation and Topography: 1,000 to 4,000 feet, increasing gradually from east to west. This broad dissected limestone plateau has gently undulating divides and broad valleys. Valley sides are steeply sloping to rolling or hilly. Relief is in several tens of feet to one or two hundred feet; near the margins, the valleys are several hundred feet below the plateau top.

Climate: *Average annual precipitation*—15 to 35 inches; highest in late spring and early autumn and least in midsummer and midwinter. *Average annual temperature*—60° to 70° F. *Average freeze-free period*—Mainly 220 to 240 days but 260 days along the southern margin.

Water: The low to moderate rainfall is adequate for range grasses but is marginal for dryfarming. All major streams are perennial but their flow fluctuates. Many of the small streams flow only during rainy periods. Along the margins of the plateau large springs flowing from the limestones provide abundant water. Wells in the limestones provide water for livestock and for domestic needs on the plateau and locally for some irrigation.

Soil: Shallow *Lithosols* (Tarrant, Brackett, and Ector) underlain by limestone occupy the more sloping parts. *Grumusols* (San Saba, Tobosa, and Valera) are in valleys and on nearly level uplands, *Calcisols* (Uvalde) on better drained level to gentle slopes where soil materials are less clayey, and *Alluvial soils* (Frio and Blanco) on narrow flood plains.

82—Texas Central Basin

Texas
3,000 square miles

Land Use: Nearly all the land is in farms and ranches. More than four-fifths of the area is in range of shrubs and grasses, and an additional 10 percent is open oak-juniper woodland that has a ground cover of tall and short grasses. All this land is grazed by cattle and sheep. About 5 percent of the area is cropland. Peanuts, winter wheat, and peaches are the principal cash crops, and grain sorghum and small grains are grown for livestock feed.

Elevation and Topography: 800 to 1,300 feet. The rolling to hilly uplands are crossed by a few smooth valleys and many steep hills and ridges. Local relief is mainly in a few tens of feet but some ridges, especially those underlain by limestone, rise several hundred feet above the level of the valleys.

Climate: *Average annual precipitation*—25 to 30 inches; highest in spring and autumn. *Average annual temperature*—About 65° F. *Average freeze-free period*—About 240 days.

Water: The moderate rainfall is adequate for range grasses but is marginal for crops because of high summer temperatures and evaporation. Only a few of the large streams flow throughout the year. They are potential sources of irrigation water but are not so used at present. Shallow wells provide water for livestock and domestic needs.

Soil: *Reddish Prairie soils* (Tishomingo, Pedernales, Pontotoc, and Harley) occupy the smoother slopes of uplands and valleys, *Lithosols* (Darnell) the steep hill slopes, and rough stony land the steepest slopes and cliffs of limestone and the granite ridges.

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83—Rio Grande Plain

Texas

31,900 square miles

Land Use: Nearly all the land is in farms and ranches. About four-fifths of it is in range of native shrubs and grasses grazed by beef cattle. Nearly 10 percent of the area, mainly along the Rio Grande and Nueces Rivers, is irrigated. Cotton, seed corn, sweet corn, citrus fruit, melons, and many kinds of vegetables are grown. About the same amount of land in the north and the east is used for crops without irrigation or with only supplemental irrigation. Cotton, grain sorghum, flax, and hay are the principal crops.

Elevation and Topography: Sea level in the southeast to 1,000 feet in the northwest. This plain is nearly level to gently undulating. Valleys are few, widely spaced, and shallow. Local relief is mainly in a few feet to a few tens of feet.

Climate: *Average annual precipitation*—20 to 35 inches; highest in spring and autumn. *Average annual temperature*—About 70° F. *Average freeze-free period*—260 to 320 days.

Water: The high summer temperatures reduce the effectiveness of the relatively low to moderate rainfall. The Rio Grande and Nueces Rivers provide water for irrigation, but the smaller streams have a small and intermittent flow and are little used for irrigation. Ground water is abundant throughout the area, and wells provide water for livestock, domestic use, and some irrigation.

Soil: *Grumusols* are extensive (Montell in calcareous clays in the northern and central parts of the area and Lomalta, a slightly saline soil, along the coast). *Reddish Chestnut soils* (Duval, Miguel, and Willacy in less clayey and somewhat less limy materials and Goliad over caliche) are also extensive. *Lithosols* (Zapata) are confined to the low narrow ridges and low plateaulike areas. Sandy *Regosols* (Nueces, Galveston, and Eufaula) occur along the coast, along the Rio Grande, and in the northeast and a clayey *Regosol* (Maverick) in the west. *Calcisols* (Hidalgo and Uvalde) are in sandy and silty old alluvium on stream terraces and deltas in the south and west and *Alluvial soils* (Frio, Harlingen, and Laredo) on narrow flood plains and deltas.

J—SOUTHWESTERN PRAIRIES COTTON AND FORAGE REGION

63,300 square miles

This region consists of the prairies and timbered areas of eastern Texas and south-central Oklahoma. The average annual precipitation ranges from 25 to 42 inches. Average annual temperatures are 60° to 70° F., and the freeze-free season is 200 to 280 days long.

Grumusols, Rendzinas, and Lithosols from limestone and chalks are the more extensive soils. Red-Yellow Podzolic soils, Planosols, and Reddish Prairie soils are also important groups.

The region is intensively farmed. Cotton, grain sorghums, other feed grains, and hay are important crops. Most of the more sloping areas in the west are in open timberland, which is used for grazing.

84—Cross Timbers

Texas and Oklahoma
17,700 square miles

Land Use: Nearly all the land is in farms and ranches. About one-half is in range of shrubs and grasses and an additional one-fourth is open woodland that has a grass understory. All this land is used for grazing. About one-fifth of the area, consisting of deep gently sloping soils both in valleys and on uplands, is cropland. Small grains, grain sorghum, alfalfa and other hay, and cotton are the major crops over much of the area. Peanuts, tree fruits, and vegetables occupy large acreages in the south.

Elevation and Topography: 1,000 to 1,200 feet but only 600 feet along the Red River. Ridgetops on these rolling to hilly uplands are nearly level to strongly rolling and narrow to moderately broad. Stream valleys are narrow and have steep gradients. Local relief is mostly in several tens of feet but the large valleys are 200 feet or more below the adjacent uplands.

Climate: *Average annual precipitation*—25 to 35 inches but as much as 45 inches in the east; highest in spring and early summer. *Average annual temperature*—60° to 65° F. *Average freeze-free period*—200 to 240 days.

Water: Pasture and crops depend mostly on the moderate and somewhat erratic rainfall. Large reservoirs provide water for cities and towns and for recreation. Farm ponds are a major source of water for livestock. Shallow wells supply water for domestic use in most of the area, but where sandstones and shales are near the surface, ground water is scarce.

Soil: *Red-Yellow Podzolic soils* are dominant in much of the area (Bowie, Boswell, and Kirvin in the humid east and Stephenville, Windthorst, and Nimrod—less acid and having darker surface layers than typical for the group—in the drier western part) and *Lithosols* (Darnell) and rough stony land on hilly to steep ridge slopes and valley sides. *Brunizems* (Dennis and Bates) occur in small areas underlain by sandstones in the north, *Planosols* (Axtell and Tabor) on flats underlain by heavy clays, and *Alluvial soils* (Yohola, Miller, Gowen, and Frio) on narrow flood plains of some larger streams.

85—Grand Prairie

Texas and Oklahoma
12,700 square miles

Land Use: The entire area is in farms and ranches. More than half is in range consisting of short grasses, bunch grasses, mesquite, scrub oak, juniper, and cedar. Beef cattle are the principal livestock and sheep are important in the southern part. The deeper soils on gentle slopes, about one-third of the area, are in cropland. Small grains, grain sorghum, cotton, corn, and hay are the principal crops.

Elevation and Topography: 800 to 1,200 feet, Arbuckle Mountains 1,350 feet. The low rugged Arbuckle Mountains are in the north of this otherwise rolling to hilly dissected plateau. Stream valleys are shallow and narrow in their upper reaches but deepen and broaden near the margins in the east. Broad areas in central Texas are gently sloping but steep slopes border valleys of the larger rivers and occupy most of the Arbuckle Mountains. Relief is mainly in tens of feet, but the large valleys are 100 feet or more below the adjacent uplands. The Arbuckle Mountains rise several hundred feet above the adjoining plain.

Climate: *Average annual precipitation*—30 to 35 inches; highest in spring and early summer. *Average annual temperature*—About 65° F. *Average freeze-free period*—200 to 240 days.

Water: Crops, pasture, and range depend on the moderate but somewhat erratic rainfall. The large rivers flow the year round and are a potential source of water for irrigation but are little used at present. Ground water is abundant and there are many springs and wells throughout the area.

Soil: *Grumusols* (San Saba) and *Brunizems* (Denton) underlain by relatively soft limestones are the dominant soils on most of the gentle slopes and *Lithosols* (Tarrant and Brackett) on steeper slopes of similar materials. *Reddish Prairie soils* (Durant and Newtonia) are on smooth uplands underlain by sandstones, shales, and limestone. Rough stony land occupies the Arbuckle Mountains, walls of the more deeply incised valleys, and the steepest hills. *Alluvial soils* (Frio and Gowen) are on flood plains of the larger streams.

86—Texas Blackland Prairie

Texas, 19,700 square miles; Arkansas, 700 square miles

Land Use: Nearly all this area is in farms. In Texas, two-thirds or more is cropland, about one-sixth is in pasture, and the remainder is in abandoned fields or narrow strips of woodland along streams. The small outlier in Arkansas is about one-fourth cropland, three-fifths pasture, and the remainder woodland. Cotton is the major cash crop, but small grains, grain sorghum, corn, and johnsongrass and other hay occupy a larger total acreage. The present trend is to a decrease in cropland and an increase in pasture on the more sloping and eroded soils.

Elevation and Topography: 300 to 800 feet, increasing gradually from south to north and from east to west. On these undulating to gently rolling dissected plains, gentle upland slopes merge into narrow valleys with more sloping sides. The large rivers that cross the area have broad but shallow valleys. The only significant tracts of hilly land are along the western margin in Texas. Relief is mainly in a few feet to a few tens of feet.

Climate: *Average annual precipitation*—30 to 50 inches; highest in spring and lowest in summer and fall. *Average annual temperature*—63° to 70° F. *Average freeze-free period*—230 to 280 days.

Water: The moderate rainfall is adequate for crops and pastures in many years, but summer droughts that reduce crop yields are fairly common. The many reservoirs that have been built recently on the larger streams help control floods, furnish municipal water supplies, and provide recreational facilities. Small farm ponds on individual farms are an important source of water for livestock. Ground water is scarce throughout the area, but a little water is obtained from wells in a few places.

Soil: Dark *Grumusols* (Houston Black, Houston, Hunt, and Vaiden) on gently sloping to nearly level uplands underlain by marls, soft limestones, and highly calcareous clays are dominant. *Rendzinas* (Austin, Lewisville, and Binnsville) are on strongly sloping areas of chalk. *Planosols* (Wilson) are in the less calcareous clays along the eastern side of the main body of this resource area and are the dominant soils in the small outliers in southeast Texas and in Arkansas. *Alluvial soils* occur on flood plains (Miller, Norwood, and Trinity on those of rivers that flow into the area from the west and Frio, Kaufman, and Gowen on those along the larger streams originating within the area).

87—Texas Claypan Area

Texas

13,200 square miles

Land Use: Nearly all the land is in farms and about half is in woodland. Open post oak savannas that have a thin understory of bunch grasses and brush are dominant over much of the area but there are some pine-hardwood forests in the east. Hardwood forests of oak, elm, pecan, and other species grow on some of the wet bottom lands. About one-half of the area has been cropped at some time but very little is now cultivated. Cotton, grain sorghum, corn, alfalfa, and other hay were grown formerly, but at present cropland is confined almost entirely to some of the sandier soils in the north where truck crops, peanuts, and fruit are grown. Most of the cleared land is now in pasture of native and volunteer grasses that have a low carrying capacity. Clearing of woodland and abandoned cropland for improved pasture is the present trend.

Elevation and Topography: 200 to 500 feet. On this nearly level to gently sloping coastal plain, valleys are narrow and shallow in their upper reaches. Valleys of large streams are shallow, and the wide flood plains are bordered by nearly level terraces. Local relief is mainly in a few feet to a few tens of feet.

Climate: *Average annual precipitation*—34 to 42 inches; highest in winter and spring and lowest in summer and autumn. *Average annual temperature*—65° to 70° F. *Average freeze-free period*—240 to 280 days.

Water: Crops and pasture depend on the moderate rainfall. Summer rainfall is erratic and yields are reduced by lack of moisture in most years. A few large reservoirs provide municipal water supplies and also serve as recreational facilities. Over much of the area water for livestock is obtained from small ponds on individual farms. On many farms water for domestic use comes from shallow wells, but in some places deep wells are needed. The deep wells provide large amounts of good-quality water.

Soil: *Planosols* in clay (Lufkin, Tabor, and Axtell) are dominant over much of the area. *Red-Yellow Podzolic soils* (Boswell, Cuthbert, Caddo, and Norfolk) are in the less clayey and more acid materials along the eastern edge and *Regosols* (Lakeland) in deep sands. *Alluvial soils* (Miller, Norwood, Gowen, and Navasota) are on flood plains.

K—NORTHERN LAKE STATES FOREST AND FORAGE REGION

103,200 square miles

Poor soils and a short cool growing season impose severe restrictions on agriculture in this region. The annual precipitation ranges from 20 to 32 inches; the heaviest rainfall occurs during the growing season. Average annual temperatures are 35° to 45° F., and the freeze-free season ranges from slightly less than 100 days to 140 days.

Podzols in sandy parent materials and Gray Wooded soils in finer textured parent materials are the dominant soils in the better drained areas. Bog soils, Humic Gley soils, Low-Humic Gley soils, and Ground-Water Podzols occupy the wet uplands and depressions. Lithosols and rough stony land are extensive on hills and low mountains.

A large part of this region is forested, and lumbering and recreation are the principal uses. Mining is a major industry in all but the eastern part of the region. Forage and some grains for livestock are the main crops in the farmed areas. Potatoes are important locally.

88—Northern Minnesota Swamps and Lakes

Minnesota
20,700 square miles

Land Use: More than 80 percent of the area is in forest and lakes; lumbering and recreation are the major uses. Only 10 to 15 percent is cropland, and 3 or 4 percent is in pasture. Forage for livestock is the principal crop, but some feed grains and legume seeds are grown also.

Elevation and Topography: 1,100 to 1,500 feet, increasing from northwest to southeast, some ridges in the south more than 1,700 feet. A broad lake plain including large swamps and many lakes makes up the northern half and a rolling glacial moraine broken by areas of outwash the southern part. The northern part is nearly level and has only slight local relief, but in the south some ridges rise 100 to 200 feet above the adjacent lowland.

Climate: *Average annual precipitation*—20 to 25 inches; highest from midspring to early autumn; winter precipitation is snow. *Average annual temperature*—35° to 40° F. *Average freeze-free period*—100 to 130 days.

Water: Abundant water supplies meet all present needs in the area. The many lakes provide recreational facilities. Much of the lowland must be drained before it can be used for general agricultural crops or tame pasture.

Soil: *Gray Wooded soils* (Nebish, Rockwood, Beltrami, and Taylor) from calcareous glacial till and clays are dominant. *Bog soils* occupy broad level areas in the Lake Agassiz basin; other soils in this basin are *Podzols* (Hiwood) and *Low-Humic Gley soils*. Of small total extent but locally conspicuous in the south are *Brunizems* (Wadena and Hubbard) from glacial outwash.

89—Minnesota Rockland Hills

Minnesota
3,500 square miles

Land Use: Nearly all the area is in national forest used for recreation and lumbering. Timber production is low because of the unfavorable soils.

Elevation and Topography: 1,200 to 2,000 feet, increasing from west to east, narrow strip bordering Lake Superior about 600 feet. Lakes, swamps, and other wet lowlands are scattered through the irregular low hills. Hills rise 200 to 300 feet above the adjacent lakes and lowlands.

Climate: *Average annual precipitation*—25 to 30 inches; highest from midspring through early autumn; winter precipitation is snow. *Average annual temperature*—35° to 40° F. *Average freeze-free period*—100 to 120 days.

Water: Water from lakes and streams is ample for present and future needs. Many lakes are suited to recreational uses but are little developed at present.

Soil: Detailed information is lacking. Large areas of acid and basic crystalline rock outcrops are intermingled with extensive areas of *Lithosols* on low hills. There are small areas of *Podzols* and *Gray Wooded soils* in the deeper glacial-till deposits. Some *Low-Humic Gley soils* and *Bog soils* occupy the lowlands among the hills.

90—Central Wisconsin and Minnesota Thin Loess and Till

Minnesota and Wisconsin
26,200 square miles

Land Use: Nearly all the area is in farms except the part west of Lake Superior, which is in State and National forests. Slightly more than one-fourth is cropland used mainly for growing feed grains and forage for dairy cattle. Potatoes are an important cash crop locally, and other vegetables and fruit are grown on some of the sandy soils. About one-sixth of the area is in pasture of tame and native grasses. Most of the remainder is in forest, mainly farm woodlots. The State and National forests are used for both timber production and recreation.

Elevation and Topography: 1,050 to 1,750 feet, narrow band along the shore of Lake Superior about 600 feet. The level to rolling till plains are mantled locally by silt. Topography is irregular; there are low hills and ridges throughout and many lakes in basins. Local relief is mainly in a few feet to a few

tens of feet, but some hills rise 100 or 200 feet above the adjacent lowlands.

Climate: *Average annual precipitation*—25 to 30 inches; highest from late spring through early autumn; winter precipitation is snow. *Average annual temperature*—40° to 45° F. *Average freeze-free period*—120 to 140 days.

Water: The moderate rainfall is generally adequate for crops and pasture, but crops on sandy soils are damaged by lack of moisture in dry years. Much of the somewhat wet and wet lowland needs to be drained before crops and tame pastures can be grown successfully. Ground water is abundant in deep glacial drift but scarce where the drift is thin. The many lakes provide recreational facilities.

Soil: Detailed modern soil surveys are lacking for most of the area. Available information indicates that *Gray-Brown Podzolic soils* (Santiago, Otterholt, and Spencer) in silt-mantled till and *Gray Wooded soils* (Hibbing and Milaca) in noncalcareous till are the dominant soils. *Podzols* (Cloquet) in more acid till are important in the east. In the northwest *Brown Forest soils* (Ahmeek) and *Sols Bruns Acides* (Brainerd) are in stony till having a relatively low lime content and rock outcrops are common on the steeper hills. Soils in wet areas include somewhat wet *Gray-Brown Podzolic soils* (Almena and Freer), *Low-Humic Gley soils* (Warman and Nokay), *Humic Gley soils* (Adolph), and *Bog soils.*

91—Wisconsin and Minnesota Sandy Outwash

Wisconsin and Minnesota
8,000 square miles

Land Use: About 90 percent of the area is in farms; about 10 percent, mostly in Wisconsin, is owned by Federal and State Governments. Nearly one-third of the area is cropland. Feed grains and forage for livestock are the main crops, but truck crops are important also. Some of the wet areas are cranberry bogs. About one-tenth is in forest used mainly for timber production. These forests and associated lakes provide recreational facilities.

Elevation and Topography: 900 to 1,100 feet. Topography is irregular on this nearly level to gently rolling outwash plain. In Minnesota there are many lakes, both large and small, in basins and depressions. Local relief throughout the area is in a few feet to a few tens of feet.

Climate: *Average annual precipitation*—About 25 inches in Minnesota and 30 to 32 inches in Wisconsin; highest from midspring to early autumn; winter precipitation is snow. *Average annual temperature*—40° to 45° F. *Average freeze-free period*—About 140 days.

Water: On sandy soils the moderate rainfall is barely adequate for crops and pasture in normal years and in dry years crop yields are seriously reduced. Irrigation is widely used for high-value crops. In contrast, the wet lowlands need to be drained before the common cultivated crops and tame pastures can be grown successfully. Ground water is abundant in the glacial deposits. The many lakes are used for recreation.

Soil: The dominant soils are weakly developed *Gray-Brown Podzolic soils* (Coloma) and *Regosols* (Plainfield and Zimmerman) in sandy glacial outwash. On the associated wet lowlands also underlain by outwash are *Humic Gley soils* (Newton, Dillon, and Isanti), *Low-Humic Gley soils* (Roscommon, Granby, and Kinross), and *Bog soils.*

92—Superior Lake Plain

Minnesota, Wisconsin, and Michigan
3,000 square miles

Land Use: More than three-fourths of the area is in forest, nearly all privately owned and used for timber production and recreation. Between 5 and 10 percent is cropland. Feed grains and hay for dairy cattle and other livestock are the principal crops. Locally, potatoes and small fruit are important cash crops. Only 1 or 2 percent of the land is in pasture.

Elevation and Topography: 600 to 1,000 feet, increasing gradually from lakeshore inland. This nearly level lake plain has some inclusions of rocky knobs, hills, and low mountains. Local relief on the lake plain is in only a few feet, but the adjoining hills and mountains rise sharply 100 feet to several hundred feet above the plains.

Climate: *Average annual precipitation*—25 to 30 inches; highest in midsummer and lowest in midwinter; winter precipitation is snow. *Average annual temperature*—38° to 40° F. *Average freeze-free period*—Less than 100 days to 140 days, decreasing from the lakeshore inland.

Water: Rainfall is adequate for crop and pasture needs. Level areas of moderately wet and wet soils need to be drained before cultivated crops can be grown successfully. There are few inland lakes, but much of the area has access to Lake Superior for recreation.

Soil: *Gray Wooded soils* (Ontonagon, Watton, and Hibbing) from fine-textured lacustrine sediments and glacial till are dominant. *Low-Humic Gley soils* (Pickford and Bergland) occupy wetter areas and *Podzols* (Munising, Iron River, Gogebic, and Hiawatha) are in acid sandy materials.

93—Northern Michigan and Wisconsin Stony, Sandy, and Rocky Plains and Hills

Wisconsin and Michigan
21,400 square miles

Land Use: More than four-fifths of the area is in forest, mostly privately owned; about one-sixth is in national forest. Lumbering and mining are important industries, and recently recreational use of the area has increased. Only about 10 percent is cropped or in pasture. Feed grains and forage for dairy cattle and other livestock are the main crops. Potatoes are an important cash crop in places. Cultivated blueberries are grown on some of the acid sandy soils having a high water table, mainly in Michigan, and cranberries in some of the bogs.

Elevation and Topography: 1,100 to 1,700 feet, some mountains more than 1,800 feet, and a narrow

strip bordering the Great Lakes about 600 feet. These undulating glacial-drift plains are bordered on the north by rugged hills or low mountains. Local relief is mainly in a few tens of feet to 100 or 200 feet; the hills and mountains rise several hundred feet above the adjacent lowlands. The area is dotted by many small lakes and a few large lakes.

Climate: *Average annual precipitation*—About 30 inches; highest in midsummer and lowest in midwinter; winter precipitation is snow. *Average annual temperature* 38° to 42° F. *Average freeze-free period*—80 to 140 days, decreasing with increasing elevation and from the Great Lakes inland.

Water: On the coarse-textured soils, rainfall supplies barely enough moisture for crops and pasture in many years. In contrast, the wet lowlands must be drained before the common field crops and tame pastures can be grown successfully. Ground water is abundant in areas covered by deep glacial drift, but where the drift is thin, ground water is scarce. The many lakes used for recreation by people from the populous areas in the south are an important economic resource.

Soil: *Podzols* are the dominant soils (chiefly Munising, Vilas, Pence, Iron River, Gogebic, and Hiawatha from sandy glacial drift and Stambaugh in the small areas of silt-mantled drift in the central part). *Regosols* (Omega) are in rapidly drained deep sands; *Low-Humic Gley soils* (Roscommon) and *Bog soils* (Spalding, Greenwood, Lupton, and Carbondale) are extensive on wet lowlands. Stony land and rockland occupy parts of the steeper slopes, knobs, hills, and low mountains.

94—Northern Michigan Sandy Drift

Michigan
20,400 square miles

Land Use: More than four-fifths of the area is forested and about one-fifth is in national forest. Most of the remaining forest is in small holdings; there are a few large holdings. Lumbering and recreation are the principal uses of these forests in the Upper Peninsula where only 1 or 2 percent of the land is in crops and pasture. In the Lower Peninsula about one-fifth of the land is in crops and pasture. Forage and feed grains for dairy cattle and other livestock are the principal crops. Potatoes are an important cash crop in places, and other vegetables and some fruit are grown also.

Elevation and Topography: 600 to 970 feet in the Upper Peninsula, increasing gradually from the shores of the Great Lakes inland; in the Lower Peninsula, 600 feet along the lakeshores to more than 1,500 feet in the central part. This broad glacial-drift plain includes belts of morainic hills, especially in the Lower Peninsula. Much of the area is nearly level to gently rolling and has local relief of only a few feet, but the morainic areas have local relief of several tens of feet to a few hundred feet.

Climate: *Average annual precipitation*—About 30 inches, fairly evenly distributed through late spring, summer, and early autumn and lowest in winter; winter precipitation is mainly snow. *Average annual temperature*—40° to 45° F. *Average freeze-free period*—120 to 140 days along the lakeshores.

Water: Because of the only moderate rainfall, moisture must be carefully managed to insure enough water for crops and pasture on the sandy soils. The wet lowlands must be drained before the common field crops and tame pastures can be grown. Ground water is abundant in the deep glacial drift that covers nearly all the area. The many lakes, both large and small, are used extensively for recreation.

Soil: *Podzols* (Rubicon, Kalkaska, Montcalm, McBride, and Emmet) from sandy glacial drift are the dominant soils. Associated with them are *Regosols* (Grayling) in excessively drained deep sands and *Low-Humic Gley soils* (Roscommon, Ensley, and Edmore) on poorly drained flats and in depressions. In fine-textured materials containing more lime *Gray Wooded soils* (Nester, Kawkawlin, and Ontonagon) are the major soils, and *Humic Gley soils* (Bergland, Bruce, and Sims) and *Low-Humic Gley soils* (Pickford) occupy the associated wet lowlands. *Bog soils* (Carbondale and Lupton) are extensive in basins and depressions throughout.

L—LAKE STATES FRUIT, TRUCK, AND DAIRY REGION

61,200 square miles

The soils and climate in this region of nearly level to gently sloping, glaciated plains are favorable for agriculture. The average annual precipitation ranges from 28 to 36 inches over most of the region but increases to 45 inches in the extreme eastern part. Distribution is fairly even throughout the year. Average annual temperatures are 45° to 51° F. over most of the region but only 42° F. in the northwestern part. The freeze-free season is 140 to 170 days, except in narrow belts adjacent to the Great Lakes where it is as long as 200 days.

Gray-Brown Podzolic soils are dominant throughout this region, but Humic Gley soils, Low-Humic Gley soils, and Bog soils are extensive in the level areas and depressions.

The region has a wide variety of agricultural enterprises. Dairy farming is important, especially near the larger urban centers. Canning crops, corn, soft winter wheat, beans, and sugar beets are among the leading crops. Fruit growing is very important in a narrow belt adjacent to the Great Lakes. Rural residences occupy much land near many of the larger cities, and a little farming is done on a part-time basis by people who earn their main income in the cities.

95—Southeastern Wisconsin Drift Plain

Wisconsin and Illinois
14,200 square miles

Land Use: More than 90 percent of the area is in farms and nearly two-thirds is cropland. Feed grains and hay are the most extensive crops. Much of the grain is fed to dairy cattle and other livestock on the farms where it is grown, but cash-grain farming is also important. Canning crops, potatoes, fruit, and other specialty crops are important, especially along the lakeshore. Between 5 and 10 percent of the area is in tame pasture, and 10 to 20 percent is in farm woodlots. Five to ten percent is urban, mostly in the south.

Elevation and Topography: 600 to 950 feet. This area consists of a glaciated plain and belts of morainic hills, beach ridges, and outwash terraces. Drumlins (long low steep-sided oval hills) are a prominent feature in the southwest. Local relief is mainly in a few feet to a few tens of feet, but the moraines and drumlins rise 100 to 250 feet above the adjacent lowlands.

Climate: *Average annual precipitation*—30 to 32 inches; highest from midspring through late summer and lowest in winter when it is mostly snow. *Average annual temperature*—Mainly 45° to 48° F. and 42° F. along the northern edge. *Average freeze-free period*—140 to 170 days, decreasing from south to north and from the Lake Michigan shore inland.

Water: Rainfall provides enough moisture for crops and pasture, but in years of below-normal rainfall yields are reduced on the coarse-textured soils. Many of the fine-textured soils need artificial drainage so that tillage and harvesting can be done more easily. The poorly drained soils must be drained before cultivated crops can be grown successfully. Ground water is abundant in the underlying drift; the sandy and gravelly outwash yields the largest amounts. Lake Michigan and the many inland lakes provide recreation for this and adjoining areas.

Soil: *Gray-Brown Podzolic soils* (Miami, Kewaunee, and McHenry) in medium- to fine-textured glacial drift that has a thin silt mantle are dominant throughout the area. In the south *Brunizems* (Warsaw, Saybrook, Parr, Wea, Dodgeville, and Tama) occupy nearly level prairie outliers on drift plains. *Podzols* (Emmet and Onaway) are in coarse-textured materials in the northeast. *Humic Gley soils* (Poygan, Kokomo, and Brookston) and *Bog soils* (Carlisle) are on wet lowlands throughout.

96—Western Michigan Fruit Belt

Michigan
2,500 square miles

Land Use: About two-thirds of the area is in forest, mainly farm woodlots, but 10 percent or more is in State and National forests. Most of the remainder is cropland; about 5 percent is in pasture. Forage and feed grains for dairy cattle occupy most of the cropland, but fruit and specialty crops are of greater economic importance. This is one of the largest cherry-producing areas in the United States. Potatoes and vegetable crops are grown, especially in the north.

Elevation and Topography: 600 to 1,100 feet. The area consists mainly of rolling to hilly moraines and beach ridges, but it includes some nearly level plains. Local relief is mainly in several tens of feet to 100 or 200 feet; the plains have relief of only a few feet. Much of the area rises sharply from the lakeshore to the adjoining hilltops.

Climate: *Average annual precipitation*—About 30 inches; fairly evenly distributed through the year but low in late winter and early spring; winter precipitation is snow. *Average annual temperature*—45° to 47° F. *Average freeze-free period*—140 to 170 days, increasing from north to south.

Water: The moderate rainfall is adequate for crops in normal years but in below-normal years yields are

reduced, especially on the deep well-drained sandy soils. Ground water is abundant in the deep sandy glacial drift. The many bays along Lake Michigan and the numerous inland lakes are well-known vacation areas.

Soil: *Podzols* (Montcalm, Kalkaska, Emmet, and Rubicon) in moderately coarse to coarse textured drift are the dominant soils and associated with them are *Regosols* (Grayling) in deep acid sands. *Low-Humic Gley soils* (Roscommon) also in deep sands are locally conspicuous but of small total extent. *Gray Wooded soils* (Nester, Kawkawlin, and Selkirk) are in fine-textured drift in the south and *Bog soils* (Carbondale and Lupton) on many small and a few large flats and depressions.

97—Southwestern Michigan Fruit and Truck Belt

Michigan
1,700 square miles

Land Use: Nearly four-fifths of the area is in farms and slightly more than one-half is cropped. Fruits, especially peaches and grapes, are grown extensively near the Lake Michigan shore. Many other fruits, vegetables, and melons are grown also. Forage and feed grains for dairy cattle and other livestock are important. Some land is in permanent pasture, but most of the farmland not in crops is in woodlots. A large part of the land not in farms is in State forests and parks and about 5 percent is urban.

Elevation and Topography: 600 to 800 feet, some hills 1,000 feet. This area consists of a nearly level glacial-drift plain and scattered gently to strongly rolling morainic hills. Local relief is in only a few feet in much of the area, but in the rolling areas local relief is in several tens of feet to 100 or 200 feet.

Climate: *Average annual precipitation*—32 to 36 inches; fairly evenly distributed through the year but slightly higher in late spring and early summer and lowest in midwinter as snow. *Average annual temperature*—48° to 50° F. *Average freeze-free period*—160 to 180 days, decreasing from west to east.

Water: The moderate rainfall is adequate for crops in normal years but in below-normal years yields are reduced by lack of moisture. Most of the fine-textured soils need some artificial drainage to improve timing of tillage operations, and wet areas must be drained before they can be used successfully for crops. The deep glacial deposits yield an abundance of ground water for domestic, municipal, and industrial uses. The many small lakes are used extensively for boating, fishing, and other recreation.

Soil: *Gray-Brown Podzolic soils* (Kalamazoo and Oshtemo) from moderately coarse and coarse glacial drift are the dominant soils. Associated with them in the coarsest deep sands are *Regosols* (Plainfield). Other *Gray-Brown Podzolic soils* in finer textured materials (Miami, Conover, St. Clair, Morley, and Blount) are locally conspicuous but of small total extent. *Bog soils* (Carlisle) are in small to medium-sized depressions and basins throughout the area.

98—Southern Michigan Drift Plain

Michigan and Indiana
17,200 square miles

Land Use: About three-fourths of the area is in farms; much of the remainder is urban although some is in State forests and parks. Nearly one-half of the area is cropped. Corn, other feed grains, and hay for dairy cattle and other livestock are the major crops. Soft winter wheat, dry beans, and potatoes are important cash crops, and fruit and vegetables are grown in many places where soils and markets are favorable. Less than 10 percent of the area is in permanent pasture and most of the rest of the land in farms is in small woodlots.

Elevation and Topography: 750 to 1,000 feet, some hills more than 1,100 feet. This broad glaciated plain is deeply mantled by till and outwash. Much of the area is level to gently rolling and local relief is in a few feet to a few tens of feet. Belts of morainic hills have stronger slopes and relief of a few tens of feet to 100 or 200 feet.

Climate: *Average annual precipitation*—30 to 36 inches; fairly evenly distributed through the year but slightly higher in late spring and early summer. *Average annual temperature*—45° to 50° F. *Average freeze-free period*—Mainly 140 to 150 days but 160 days in the southwest.

Water: The moderate rainfall is adequate for crops over much of the area, but moisture conservation is a serious problem on the coarse-textured soils. Ground water is abundant in the deep glacial drift. Many small and medium-sized lakes and many perennial streams are additional sources of water and are used extensively for recreation.

Soil: *Gray-Brown Podzolic soils* (Fox, Kalamazoo, Oshtemo, Hillsdale, Miami, Lapeer, and Conover) in medium- to coarse-textured acid and calcareous glacial drift are the dominant soils in much of the area. Associated with them in flats and depressions are *Humic Gley soils* (Brookston, Gilford, Maumee, and Newton) and *Bog soils* (Houghton, Carlisle, and Edwards). In the northwest *Podzols* (Montcalm, Kalkaska, Emmet, and McBride) are the principal soils. Associated with them in wet areas are *Low-Humic Gley soils* (Roscommon, Edmore, and Ensley) and *Bog soils* (Carbondale and Lupton). On prairie outliers in the south *Brunizems* (Warsaw and Door) are conspicuous locally but are of small total extent.

99—Erie-Huron Lake Plain

Michigan and Ohio
12,200 square miles

Land Use: Nearly nine-tenths of the area is in farms and about two-thirds is cropland. This is an important cash-crop area. Corn, winter wheat, soybeans, and hay are the major crops, and sugar beets and canning crops are also important. Some fruit and truck crops are grown on the coarse-textured soils. Dairying is important on some farms near the larger cities. The remaining farmland includes small areas in permanent pasture and miscellaneous uses, but

most of it is in small farm woodlots. About 10 percent of the area is urban.

Elevation and Topography: 600 to 800 feet, increasing gradually from the lakeshores inland. Local relief on most of this nearly level broad lake plain is in only a few feet, but some beach ridges and low moraines rise several feet to a few tens of feet above the general level.

Climate: *Average annual precipitation*—28 to 36 inches; fairly evenly distributed through the year but slightly higher in late spring and early summer. *Average annual temperature*—45° to 50° F. *Average freeze-free period*—140 to 160 days.

Water: The moderate rainfall provides enough water for crops in nearly all years. Many of the soils require artificial drainage before they can be used for crops, and even the better drained soils need some drainage to improve the timing of tillage operations in spring and fall. The abundant ground water meets domestic and municipal needs in much of the area. Large cities bordering the Great Lakes obtain water from the lakes, which are major transportation arteries and are used for recreation.

Soil: Medium- and fine-textured *Humic Gley soils* (Toledo, Brookston, Parkhill, Colwood, Sims, Hoytville, and Wauseon) are the dominant soils. Closely associated with them are *Low-Humic Gley soils* (Brevort, Paulding, and Latty). *Gray Wooded soils* (Kawkawlin and Capac) are important on the better drained areas in the north. In the south somewhat wet *Gray-Brown Podzolic soils* (Nappanee, Fulton, and Kibbie) are in fine- and medium-textured materials and better drained members (Seward and Ottokee) in sandy materials. There are some *Podzols* (Menominee, Iosco, and Manistee) and *Low-Humic Gley soils* in the north.

100—Erie Fruit and Truck Area

Ohio, Pennsylvania, and New York
2,700 square miles

Land Use: Slightly more than two-thirds of the area is in farms. About a third is cropland; the other third is about equally divided between pasture and woodland but small areas are in rural residences and other miscellaneous uses. The cropland is in vineyards, orchards, small fruits, canning crops, and truck crops. Dairying is also important, especially near the larger cities. A large part of the area not in farms is urban, and major highways, railroads, and parks occupy a sizable acreage.

Elevation and Topography: 600 to 900 feet, increasing gradually from the lakeshore inland. This nearly level to gently sloping plain is underlain mostly by lacustrine sediments but partially by glacial till. Low beach ridges are a prominent feature. Local relief is mainly in a few feet but in some places along the lakeshore there are steep wave-cut cliffs.

Climate: *Average annual precipitation*—30 to 35 inches; evenly distributed through the year; heavy snowfall is common in winter. *Average annual temperature*—50° to 51° F. *Average freeze-free period*—Mainly 160 to 180 days but 200 days in a narrow belt in Ohio.

Water: Rainfall is adequate for crops during most years except on the coarse-textured soils. Supplemental irrigation water for high-value fruit and vegetable crops is obtained from wells or from the Great Lakes. The wettest soils must be drained before they can be used for crops and many other soils benefit from drainage. The abundant ground water meets domestic, industrial, and municipal needs in much of the area, but some of the larger cities obtain water from the Great Lakes. The Great Lakes also provide transportation and are used extensively for recreation.

Soil: *Gray-Brown Podzolic soils* are dominant in the west (Painesville and Caneadea in fine-textured materials; Collamer, Tuscola, and Kibbie in medium-textured materials; and Coloma and Chili in coarse-textured materials). Associated soils on wet lowlands are *Humic Gley soils* (Lorain and Colwood). In the east most of the moderately and well drained soils are *Sols Bruns Acides* (Williamson, Wallington, and Chenago). The associated wet soils are mostly *Low-Humic Gley soils* (Canadice and Fredon) but there are also some *Humic Gley soils* (Toledo).

101—Ontario-Mohawk Plain

New York
10,700 square miles

Land Use: About four-fifths of the area is in farms and about two-fifths is cropland. The largest acreage is in feed and forage crops for dairy cattle but many cash crops, including canning and truck crops, various fruits, and winter wheat, are grown also. About one-fifth of the land in farms is in permanent pasture and about one-fifth in forest, mostly farm woodlots. Of the one-fifth of the area not in farms, about one-half is urban and the remainder is in miscellaneous uses, including rural residences and parks.

Elevation and Topography: 250 to 1,000 feet, increasing gradually from the lakeshore to the Allegheny Escarpment, which forms the southern boundary of the area. Most of the area is a nearly level to rolling glacial drift plain. Drumlins (long narrow steep-sided oval hills) are prominent in an east-west belt near the center of the western two-thirds of the area. Low beach ridges are common. Local relief is mainly in a few feet to a few tens of feet, but the larger drumlins rise 100 to 200 feet or more above the adjacent lowlands.

Climate: *Average annual precipitation*—35 to 45 inches, increasing from west to east; evenly distributed through the year; large amounts of snow fall in winter, especially in the west. *Average annual temperature*—45° to 50° F. *Average freeze-free period*—Mainly 140 to 160 days but 180 days in a narrow belt along Lake Ontario.

Water: The moderate rainfall is adequate for crops and pasture in most years but yields are reduced in dry years. Farm ponds, Lake Ontario, and wells supply water for supplemental irrigation of high-value crops on many farms. Ground water is abundant in most of the area. Several large lakes are used for recreation; Lake Ontario provides recreation and is a major transportation artery. The New York

Barge Canal crosses the area from east to west and is an important transportation artery.

Soil: *Gray-Brown Podzolic soils* from calcareous glacial drift are dominant (Ontario, Hilton, Honeoye, and Lima from calcareous glacial till; Odessa, Schoharie, Fulton, and Lucas in lacustrine sediments; and Palmyra in outwash). Associated with these soils are *Humic Gley soils* (Lyons and Toledo) in wet areas and *Brown Forest soils* (Nellis and Benson) on uplands where soils are thin over limestones. In more acid materials, mainly in the east, *Sols Bruns Acides* (Sodus and Williamson) are extensive. Associated with them are some *Podzols* (Camroden) and *Low-Humic Gley soils* (Marcy). *Bog soils* occupy many small depressions and a few large swamps throughout the area.

M—CENTRAL FEED GRAINS AND LIVESTOCK REGION

283,900 square miles

Fertile soils and favorable climate make this one of the outstanding grain-producing regions of the world. The annual precipitation is 25 to 35 inches over much of the region but ranges from 20 inches in the extreme northwest to 45 inches along the eastern and southeastern fringe. Somewhat more than half falls during the growing season. Average annual temperatures are 45° to 55° F. in much of the region but range from 40° F. in the extreme northwest to 63° F. in the extreme southwest. The freeze-free season is 140 to 180 days in most of the region but is as short as 130 days along the northern fringe and as long as 235 days in the extreme southwest.

Gray-Brown Podzolic soils in the east and Brunizems in the west are the dominant soils. Humic Gley soils and Bog soils on wet lowlands and Alluvial soils in bands along the major streams are also important.

Corn, soybeans, oats, and other feed grains are the most extensively grown crops. Hay, winter wheat, and many other crops are grown also. Much of the grain is fed to beef cattle and hogs on the farms where it is grown, but a large amount is shipped to other regions for livestock feed. Part of the grain is processed for food and for industrial uses.

102—Loess, Till, and Sandy Prairies

South Dakota, Minnesota, Nebraska, and Iowa
35,100 square miles

Land Use: Almost all the area is in farms and between two-thirds and three-fourths of it is cropland. Corn, wheat, other small grains, and soybeans grown for feed and for sale are the major crops. Some alfalfa and other hay are grown for beef cattle. About one-fifth of the area is in pasture. Many pastures are largely of native grasses but on the better soils tame grasses and legumes are grown as well. Less than 1 percent of the area is in woodland. Wooded areas are mainly narrow bands along streams and a few shelterbelt plantings around farmsteads.

Elevation and Topography: 1,000 to 2,000 feet. This nearly level to rolling glacial plain is mantled by loess except in the north. Slopes are long, smooth, and gentle except the hilly to steep slopes bordering some of the larger stream valleys. In the northeast slopes are irregular and short. The Missouri River and a few of its larger tributaries have nearly level to gently sloping flood plains and terraces. Relief is mainly in a few feet to a few tens of feet.

Climate: *Average annual precipitation*—20 to 30 inches, increasing from north to south and from west to east; about three-fourths falls from midspring to early autumn; the sparse winter precipitation is snow. *Average annual temperature*—40° to 50° F., increasing from north to south. *Average freeze-free period*—140 to 160 days.

Water: Crops and pasture depend on the moderate rainfall. Year to year fluctuations are large and crop yields are seriously reduced in dry years. Shallow wells in the glacial deposits are the principal source of water for domestic and livestock needs; some water for livestock is stored in small ponds and reservoirs. Many small lakes in the northeast are important for recreation.

Soil: *Chernozems* (Barnes, Forman, Aastad, Bonilla, and Vienna) are dominant in the north. *Regosols* (Buse) on more sloping areas and *Humic Gley soils* (Parnell) and *Solonetz soils* (Cavour) in depressions are extensive. In the loess-mantled parts of the area, *Chernozems* (Moody and Kranzburg) are dominant but *Regosols* (Crofton) are on the associated steeper slopes. Other *Chernozems* in stratified sediments are Poinsett and Sinai soils. *Alluvial soils* (Onawa) and *Humic Gley soils* (Luton) are the principal soils on flood plains.

103—Central Iowa and Minnesota Till Prairies

Minnesota and Iowa
27,900 square miles

Land Use: Nearly all the area is in farms and about three-fourths is cropland. Corn, soybeans, and other feed grains are the major crops. Some cropland is in hay and dairy farming is important in the north. Between 10 and 15 percent is in permanent pasture of tame and native grasses. Narrow bands of woodland on steep slopes border stream valleys, and some of the wet bottom lands are also forested. About 5 percent is urban and a like amount is in miscellaneous other uses.

Elevation and Topography: 1,000 to 1,300 feet. Most of the area is a nearly level to gently rolling till plain, but there are some morainic hills in the east. Relief is mainly in a few feet to a few tens of feet, but some major valleys are 100 to 200 feet below the adjoining uplands.

Climate: *Average annual precipitation*—25 to 33 inches; two-thirds or more falls during the freeze-free period. *Average annual temperature*—Mainly 43° to 48° F., decreasing to 40° F. in the northwest. *Average freeze-free period*—130 to 160 days.

Water: The moderate rainfall is adequate for crops but yields are reduced in years of low rainfall. Ground-water supplies are adequate for domestic,

livestock, and municipal needs. Some natural lakes and ponds and a few artificial reservoirs provide water and recreation.

Soil: *Brunizems* (Clarion and Nicollet) and soils transitional between *Gray-Brown Podzolic soils* and *Brunizems* (Lester) in medium-textured calcareous glacial till are dominant. *Gray-Brown Podzolic soils* (Hayden) are on the morainic hills in the east. Associated soils on wet flats and in depressions are *Humic Gley soils* (Webster and Glencoe).

104—Eastern Iowa and Minnesota Till Prairies

Minnesota and Iowa
9,700 square miles

Land Use: Nearly all the area is in farms and more than three-fourths is cropland. Corn, soybeans, other feed grains, and some hay for livestock are the major crops. Less than 10 percent is in pasture of tame and native grasses. A like amount is wooded, mainly wet bottom land but also steep slopes bordering stream valleys.

Elevation and Topography: 1,000 to 1,200 feet. This nearly level to gently sloping till plain has a thin mantle of loess. Local relief is mainly in a few feet to a few tens of feet. The streams have narrow and shallow valleys in their upper reaches, and only in the east is there much dissection.

Climate: *Average annual precipitation*—28 to 33 inches; more than two-thirds falls during the freeze-free period. *Average annual temperature*—43° to 47° F. *Average freeze-free period*—140 to 160 days.

Water: Rainfall is generally adequate for crops, but yields are reduced in dry years. Many of the wetter soils require artificial drainage before they can be used successfully for the common field crops. Ground water in the glacial drift is adequate for livestock, domestic, and municipal needs.

Soil: *Brunizems* (Kenyon and Ostrander) and soils transitional between *Gray-Brown Podzolic soils* and *Brunizems* (Kasson) from leached glacial till are dominant. On flats and wet drainageways *Humic Gley soils* (Floyd and Clyde) are the major soils.

105—Northern Mississippi Valley Loess Hills

Wisconsin, Iowa, Minnesota, and Illinois
18,400 square miles

Land Use: Nearly all the area is in farms but only about two-fifths is cropland. Feed grains and hay for dairy cattle and other livestock are the principal crops. About one-fifth is in permanent pasture of tame and native grasses. Nearly one-third, mainly the more sloping parts, is in forest.

Elevation and Topography: 600 feet on the valley floors to 1,200 feet on the highest ridgetops. The sloping to hilly uplands are thoroughly dissected by both large and small tributaries of the Mississippi River. Bottom lands of all streams are narrow. Around the perimeter of the area some broad ridgetops have undulating slopes. Local relief is mainly in several tens of feet to a few hundred feet.

Climate: *Average annual precipitation*—30 to 35 inches; two-thirds or more falls during the freeze-free period. *Average annual temperature*—45° to 50° F. *Average freeze-free period*—140 to 160 days.

Water: The moderate rainfall and the many perennial streams are important water sources. Ground water is abundant in outwash deposits in the valleys but the amount varies in the uplands—areas underlain by sandstone and shale commonly have a meager supply. The Mississippi River, which crosses the area, is a major transportation artery and also provides recreation.

Soil: *Gray-Brown Podzolic soils* (Fayette, Dubuque, Seaton, and Gale) from a loess mantle over bedrock or glacial till are dominant. *Brunizems* (Tama, Dodgeville, and Muscatine) are on gently sloping broad ridgetops. *Lithosols* (Boone) and steep rocky and stony land are extensive on steep slopes bordering the major valleys.

106—Nebraska and Kansas Loess-Drift Hills

Nebraska and Kansas
10,200 square miles

Land Use: Nearly all the area is in farms and between one-half and two-thirds is cropland. Wheat is the important cash crop but corn, other feed grains, and alfalfa and other hay occupy more acreage. Most of the grain and hay is fed on the farm where it is grown. About one-fourth of the area is in pasture. Pastures are of tame grasses and legumes on the better soils but of native grasses on the more sloping shallow soils. Woodland is confined to narrow bands on slopes bordering stream valleys and to some wet bottom lands.

Elevation and Topography: 1,000 to 1,500 feet, increasing from east to west. This dissected glacial-drift plain is mantled in most places by thick loess. Ridgetops are broad and smooth and slopes are undulating to rolling. Stream valleys are bordered by relatively narrow bands of hilly to steep slopes. Valley floors are narrow except along one or two of the larger tributaries of the Missouri River. Local relief is mainly in several tens of feet but some of the larger valleys are 100 to 200 feet or more below the level of the adjacent uplands.

Climate: *Average annual precipitation*—30 to 36 inches, increasing from northwest to southeast; about three-fourths falls from late spring through early autumn; the scant winter precipitation is mainly snow. *Average annual temperature*—About 55° F. *Average freeze-free period*—160 to 190 days.

Water: Rainfall is generally adequate for crops but yields are reduced in some years by lack of moisture. Locally, small areas along some of the perennial streams are irrigated. Shallow wells in glacial drift supply water for domestic and livestock needs on most farms, and small ponds and reservoirs are another important source of water for livestock. In some places deep wells provide water.

Soil: *Brunizems* are the major soils (Sharpsburg, Marshall, and Grundy on the undulating to gently

rolling loess-mantled ridgetops and upper slopes and Burchard, Pawnee, and Shelby on ridge slopes underlain by glacial till). *Regosols* are on the steep slopes (Crofton and Hamburg on steep slopes that have a deep loess cover and border the larger stream valleys and Steinauer on the lower steep slopes underlain by glacial till). *Humic Gley soils* (Wabash and Colo) are on the relatively narrow wet bottom lands along most streams.

107—Iowa and Missouri Deep Loess Hills

Iowa and Missouri
19,200 square miles

Land Use: Most of the area is in farms and about three-fifths is cropland. Corn, other feed grains, and hay for livestock are the principal crops. One-fifth of the area is in permanent pasture of tame and native grasses. About one-tenth, mainly in narrow belts of steep slopes bordering stream valleys and wet bottom land, is in forest.

Elevation and Topography: 800 feet along the Missouri River flood plain in the south to 1,500 feet on the highest ridgetops in the north. This rolling to hilly loess-mantled plain is intricately dissected. Small valleys have narrow flood plains but larger valleys have broad floors. Local relief is mainly in several tens of feet to 100 or 200 feet.

Climate: *Average annual precipitation*—25 to 36 inches; two-thirds or more falls during the freeze-free period; the low winter precipitation is mainly snow. *Average annual temperature*—45° to 55° F. increasing from north to south. *Average freeze-free period*—160 to 190 days, increasing from north to south.

Water: The moderate rainfall and abundant streamflow are important water sources. Ground water is abundant in deep outwash in the valleys but is less plentiful in the uplands. The Missouri River is a major transportation artery and is used for recreation.

Soil: *Brunizems* (Marshall, Sharpsburg, and Monona) from moderately deep to very deep loess on gentle to rolling slopes are the major soils. On steep slopes having a deep loess mantle *Regosols* (Ida and Hamburg) are extensive, but *Gray-Brown Podzolic soils* (Knox) occur in narrow bands on some slopes where moisture supplies are favorable for forest growth. *Humic Gley soils* (Marcus) are on upland flats and in depressions where loess is underlain at a moderate depth by glacial till. *Alluvial soils* (McPaul, Albaton, Haynie, and Sarpy) are on the better drained bottom lands throughout the area. *Humic Gley soils* (Wabash, Colo, and Luton) are extensive on the wet bottom lands.

108—Illinois and Iowa Deep Loess and Drift

Iowa and Illinois
34,900 square miles

Land Use: Nearly all the area is in farms and about three-fourths is cropland. Corn, soybeans, and other feed grains are grown extensively on the less sloping parts and are sold as cash crops. Where slopes are stronger, more of the land is in hay and pasture and more of the grain is fed to livestock on the farms where it is produced. About 10 percent of the area is in pasture of tame and native grasses; the narrow bands of forest on steep valley sides and wet bottom land constitute an additional 5 percent. Five percent is urban and the ramainder is in other uses.

Elevation and Topography: 500 feet on the lowest valley floors to 1,000 feet on the highest uplands, increasing gradually from east to west. Much of this dissected loess-mantled glacial plain is rolling to hilly, but some of the broad uplands far from the large streams are level to undulating. The smaller streams have narrow valley floors but the large streams have broad flood plains. Local relief is mainly in several tens of feet to 100 or 200 feet but the upland flats have relief of only a few feet.

Climate: *Average annual precipitation*—30 to 35 inches; two-thirds or more falls during the freeze-free period; the low winter precipitation is mostly snow. *Average annual temperature*—47° to 53° F. *Average freeze-free period*—160 to 180 days.

Water: The favorably distributed moderate rainfall and the many perennial streams are important water sources. Ground water is abundant in the glacial drift that underlies much of the area. The Mississippi River and a few large tributaries are transportation arteries and are used for recreation.

Soil: *Brunizems* (Tama, Muscatine, Flanagan, Sharpsburg, Shelby, and Mahaska) from loess are the dominant soils throughout the area. Associated with them on flats and in depressions are *Humic Gley soils* (Sable, Taintor, and Drummer). *Gray-Brown Podzolic soils* (Fayette, Seaton, Clinton, and Lindley) are conspicuous on the steep slopes of valley sides but constitute only 10 to 15 percent of the total area. *Alluvial soils* (Nodaway and Lawson) on the broader flood plains are locally very important to agriculture. *Humic Gley soils* (Colo and Zook) are on wet bottom land.

109—Iowa and Missouri Heavy Till Plain

Iowa, Missouri, and Illinois
17,900 square miles

Land Use: Nearly all the area is in farms and somewhat more than one-half is cropland. Corn, other feed grains, and hay for livestock are the principal crops. About one-fourth is in pasture of tame and native grasses and about 10 percent is woodland.

Elevation and Topography: 700 feet in the lowest valleys to 1,100 feet on the highest ridges. This dissected till plain has a thin loess mantle. Slopes are mostly rolling to hilly but some broad ridgetops are nearly level to undulating. The slopes bordering major stream valleys are steep. A few large rivers have nearly level broad valley floors. Local relief is mainly in several tens of feet to 100 or 200 feet, but the upland flats and valley floors have local relief of only a few feet.

Climate: *Average annual precipitation*—35 to 40 inches; about two-thirds falls during the freeze-free period; the low winter precipitation is snow. *Aver-*

age annual temperature—50° to 55° F. *Average freeze-free period*—160 to 180 days.

Water: The favorably distributed moderate rainfall provides enough water for crops in most years. The many small perennial streams and a few large streams are additional sources of water but are little used at present. Ground-water supplies are small and undependable.

Soil: *Brunizems* (Shelby, Seymour, and Grundy) from moderately fine textured glacial till or thin loess are the principal soils. On broad upland flats *Planosols* (Edina) are extensive and associated with them in the wettest areas are *Humic Gley soils* (Haig). *Alluvial soils* (Nodaway) and *Humic Gley soils* (Colo and Wabash) on the flood plains are very important to agriculture locally.

110—Northern Illinois and Indiana Heavy Till Plain

Illinois and Indiana
7,700 square miles

Land Use: Most of the area is in farms but about one-fifth of the area, consisting of Chicago and its suburbs in the north, is urban. Urbanization is removing additional land from agriculture rapidly. Farmed areas are used mainly for cash-grain farming; corn and other feed grains are the principal crops. Feed grains and forage for dairy cattle are very important in some places. Woodland occupies less than 5 percent of the area and is confined mainly to wet flood plains, steeply sloping valley sides, and morainic ridges.

Elevation and Topography: 600 to 800 feet, increasing gradually from Lake Michigan south. Streams have cut only shallow valleys over much of this nearly level to gently sloping glaciated plain. Local relief is in a few feet to a few tens of feet.

Climate: *Average annual precipitation*—30 to 35 inches; about two-thirds falls during the freeze-free period; winter precipitation is snow. *Average annual temperature*—48° to 52° F. *Average freeze-free period*—About 160 days but 180 days in a narrow belt along Lake Michigan.

Water: The favorably distributed moderate rainfall is adequate for crops in most years. Ground water is abundant in glacial drift and meets domestic and municipal needs in much of the area. The large cities in the north depend on Lake Michigan for water. A few large perennial streams are other potential sources of water but are not much used at present. Extensive areas of wet soils must be drained before they can be used for agriculture or other purposes.

Soil: *Brunizems* (Saybrook, Elliott, Swygert, and Clarence) from calcareous glacial till are the major soils. Associated with them on flats and in depressions are large areas of *Humic Gley soils* (Drummer, Ashkum, and Bryce). *Gray-Brown Podzolic soils* (Morley, Miami, and Blount) also from glacial till are dominant on small tracts of formerly forested land in the north.

111—Indiana and Ohio Till Plain

Indiana, Ohio, Michigan, and Illinois
32,900 square miles

Land Use: More than 90 percent of the area is in farms and about 80 percent is cropland. Corn, soybeans, other feed grains, and hay for livestock are the principal crops. Dairying is important near cities, and truck and canning crops are grown extensively where soils and markets are favorable. Small areas of permanent pasture and small farm woodlots make up the rest of the land in farms.

Elevation and Topography: 700 to 1,000 feet, increasing very gradually from west to east. This gently sloping glacial-till plain is broken in places by hilly moraines, kames, and outwash terraces. Relief is mainly in a few feet to a few tens of feet but locally hills rise as much as 100 feet above the adjoining plains. The few large streams commonly have narrow and shallow valleys.

Climate: *Average annual precipitation*—35 to 40 inches; half or more falls during the freeze-free period; winter precipitation is low and is mostly snow. *Average annual temperature*—50° to 55° F. *Average freeze-free period*—155 to 180 days.

Water: The favorably distributed moderate rainfall is adequate for crops in normal years but yields are reduced by drought in some years. Ground water in glacial deposits is the principal water source for domestic, industrial, and municipal uses. A few large streams, mainly tributaries of the Ohio River, are potential sources of water but are not much used at present. A few lakes in the western part of the area are widely used for recreation.

Soil: *Gray-Brown Podzolic soils* (Miami, Blount, Russell, Crosby, Fincastle, Cardington, and Morley) from calcareous glacial till that is mantled by silt in the south are the dominant soils. Associated with them on flats and in depressions are *Humic Gley soils* (Brookston) and *Bog soils* (Carlisle, Houghton, and Edwards). *Gray-Brown Podzolic soils* (Fox and Ockley) and *Humic Gley soils* (Westland) are extensive in areas of gravelly glacial outwash.

112—Cherokee Prairies

Kansas, Oklahoma, and Missouri
25,400 square miles
Arkansas—1,000 square miles

Land Use: Nearly all this area is in farms and about half is cropland. Winter wheat, soybeans, corn, grain sorghum, other feed grains, and hay are the major crops. Some cotton is grown in a few Oklahoma counties. About one-third of the area is in pasture, mainly of tame grasses and legumes but of native grasses on the more sloping parts. Much of the area in Arkansas is in pasture. About one-tenth of the area, the steeper valley slopes and some of the wet bottom land, is woodland. The amount of woodland in Kansas is considerably less than that in the other three States.

Elevation and Topography: 400 to 1,200 feet. These gently sloping to rolling dissected plains are underlain by sandstones, shales, and limestones. Thin

loess covers the northern part. Even though the area is thoroughly dissected, local relief is in only a few tens of feet and large valleys are about 100 feet below the adjacent uplands.

Climate: *Average annual precipitation*—35 to 45 inches; highest from late spring through autumn. *Average annual temperature*—55° to 63° F. *Average freeze-free period*—190 to 235 days.

Water: The moderate rainfall is adequate for crops and pasture in many years, but summer droughts of sufficient severity and duration to reduce crop yields are common. Shallow wells are the principal source of water for domestic use and for livestock in much of the area, but small ponds and reservoirs on individual farms are increasingly important sources of water for livestock. Deep wells, especially in the limestone areas, also provide water.

Soil: *Planosols* (Oswego, Parsons, Cherokee, and Taloka) on nearly level to undulating slopes are the dominant soils; associated with them on gentle slopes are *Brunizems* (Woodson, Dennis, Summit, Okemah, and Bates). *Rendzinas* (Snead) are on undulating to rolling slopes underlain by soft limestones and calcareous shales and *Lithosols* (Darnell, Sogn, and Collinsville) on more strongly sloping areas underlain by sandstones, shales, and limestone. *Alluvial soils* (Verdigris and Lightning, Pope and Philo in Arkansas) and *Low-Humic Gley soils* (Osage) on flood plains are of small total extent but are among the best agricultural soils in the area.

113—Central Claypan Areas

Missouri and Illinois
11,000 square miles

Land Use: Nearly all these areas are in farms and about three-fifths is cropland. Corn, soybeans, other feed grains, and hay for cattle and other livestock are the main crops. About one-tenth is in permanent pastures of tame and native grasses. An additional one-sixth, mainly on the steeper slopes and wet bottom land, is in forest; about 5 percent is urban and the remainder is in miscellaneous other uses.

Elevation and Topography: 750 to 950 feet in Missouri and 500 to 600 feet in Illinois, increasing gradually from south to north in both States. These areas consist of nearly level to gently sloping silt-mantled old till plains. Stream valleys are shallow and most of them are narrow. Local relief is mainly in a few feet to a few tens of feet.

Climate: *Average annual precipitation*—About 40 inches; about 60 percent falls during the freeze-free period. *Average annual temperature*—55° F. *Average freeze-free period*—180 to 190 days.

Water: The moderate rainfall is adequate for crops in most years. Low to moderate supplies of water are available from ground water. A few large perennial streams are potential sources of water that are not much used at present. Most of the soils are imperfectly to poorly drained, and claypans prevent effective artificial drainage on most of them.

Soil: *Planosols* with a claypan, mostly from loess overlying old glacial till, are the principal soils (dark-colored Putnam and Mexico in Missouri and lighter colored Hoyleton, Cowden, Cisne, Wynoose, and Bluford in Illinois). On hilly and steep valley sides *Gray-Brown Podzolic soils* (Lindley, Hickory, Weller, and Gara) are the dominant soils. *Alluvial soils* (Westerville and Sharon) and *Humic Gley soils* (Wabash) on narrow flood plains are of small total extent but are among the best agricultural soils of the area.

114—Southern Illinois and Indiana Thin Loess and Till Plain

Illinois, Indiana, and Ohio
14,400 square miles

Land Use: Nearly all the area is in farms but only about one-half is cropland. Corn, soybeans, other feed grains, and hay for dairy cattle and other livestock are the principal crops. Some tobacco is grown as a cash crop in Indiana and Ohio. About one-fifth of the area is in forest, much of which is in small farm woodlots but some is in large holdings. Most of the remaining farmland is in pasture. About 5 percent of the area, mainly along the Ohio River, is urban or in industrial use.

Elevation and Topography: 400 feet on valley floors to 1,200 feet on ridgetops, the ridgetops increasing gradually in elevation from west to east. This dissected old glacial-till plain has a moderately thick mantle of loess. Most of the ridgetops are narrow but some are broad. Ridge slopes and valley sides are steep. Local relief on the ridgetops is in a few feet to a few tens of feet but stream valleys are one to several hundred feet below the adjoining uplands.

Climate: *Average annual precipitation*—35 to 45 inches; highest in spring and early summer and least from midsummer through autumn. *Average annual temperature*—53° to 58° F. *Average freeze-free period*—180 to 200 days.

Water: The moderate rainfall is adequate for crops in most years but yields are reduced occasionally by droughts. Ground-water supplies meet domestic, industrial, and municipal needs in most of the area, but ground water is scarce in parts where shale is near the surface. Many small streams are potential sources of water not much used at present.

Soil: *Planosols* (Bluford, Vigo, Avonburg, and Clermont) from moderately thick loess over old glacial till on level to sloping ridgetops are the dominant soils. *Gray-Brown Podzolic soils* (Cincinnati and Rossmoyne) are dominant on more sloping uplands and *Rendzinas* (Fairmount) in shaly limestone materials on valley sides. *Alluvial soils* (Haymond, Belknap, and Bonnie) on the relatively narrow flood plains are of small total extent but are highly important to agriculture locally.

115—Central Mississippi Valley Wooded Slopes

Missouri, Illinois, and Indiana
19,200 square miles

Land Use: Nearly all the area is in farms and about two-fifths is cropland. Feed grains and hay for live-

stock are the principal crops, but peach and apple orchards are important on some of the more sloping parts. About one-third of the area is in forest, mainly in small farm woodlots but partly in large tracts that include some national forest. Most of the remainder of the land in farms is in pasture of tame and native grasses.

Elevation and Topography: 400 feet on the main valley floors to 1,000 feet on the ridgetops. This dissected glacial-till plain has rolling narrow ridgetops and hilly to steep ridge slopes and valley sides. The small streams have narrow valleys and steep gradients. The major rivers have nearly level broad flood plains. Valley floors are one to several hundred feet below the adjoining hilltops.

Climate: *Average annual precipitation*—35 to 45 inches; about two-thirds falls during the freeze-free season in the west; highest in spring and early summer and lowest from midsummer through autumn in the southeast. *Average annual temperature*—53° to 58° F. *Average freeze-free period*—180 to 200 days, increasing from north to south.

Water: Rainfall is adequate in most years for the crops commonly grown but yields are reduced by drought in some years. Ground water furnishes domestic and livestock needs on farms. The Mississippi, Missouri, and Ohio Rivers are major transportation arteries and are used for recreation.

Soil: *Gray-Brown Podzolic soils* are the dominant soils (Menfro, Alford, Princeton, Lindley, Weller, and Weldon in loess over old glacial till and bedrock on rolling to steep slopes and Gara and Lindley in till areas lacking the loess mantle). On ridgetops in the south *Gray-Brown Podzolic soils* with fragipans (Hosmer, Grenada, and Union) are important. *Alluvial soils* (Genesee, Haymond, Sharon, Beaucoup, Westerville, and Allison) and *Humic Gley soils* (Wabash and Darwin) on level flood plains occupy about one-tenth of the area and are among the more important agricultural soils.

N—EAST AND CENTRAL GENERAL FARMING AND FOREST REGION

236,500 square miles

This borderland region between the North and the South includes the Appalachian mountains, valleys, and dissected plateaus and the Ozarks. The annual precipitation is 40 to 50 inches over much of the region but ranges from 35 inches along the western edge to 60 inches or more on some of the higher mountains in the east. The freeze-free season is 180 to 200 days over a large part of the region but ranges from about 150 days in the northeast to as long as 240 days in some of the valleys in the south.

Sols Bruns Acides from sandstones and acid shales are the more extensive soils on the mountain slopes and dissected plateaus. Red-Yellow Podzolic soils are on limestones and more deeply weathered shales. Reddish-Brown Lateritic soils are conspicuous in some limestone valleys and basins, but their total area is small. Alluvial soils along the many streams are of small total extent, but they are cropped intensively throughout the region.

Small general farms are characteristic of much of the region, but there are large dairy and livestock farms in areas of more favorable soils. Corn, small grains, and hay are the most extensive crops. Tobacco is an important cash crop, especially in the eastern two-thirds of the region. The steeply sloping areas, amounting to nearly one-half of the region, are mainly in forests, which are used for both recreation and timber production. A large part of the Nation's coal is mined in this region.

116—Ozark Highland

Missouri, Arkansas, and Oklahoma
34,400 square miles

Land Use: About three-fifths of the area is in forest or woodland, most of it in farm woodlots but some in large holdings. About one-fifth of the area is cropland. Corn, feed grains, and hay for dairy cattle and other livestock are the principal crops, and orchards, vineyards, and truck crops are important on some of the more friable deep soils. Pastures, mainly of tame grasses and legumes, occupy most of the remaining one-fifth of the area.

Elevation and Topography: 500 to 1,500 feet. These sharply dissected limestone plateaus have narrow rolling ridgetops that break sharply to steep side slopes. Valleys are narrow and have steep gradients, especially in the upper reaches. There are some gently sloping plateau remnants in the west. Local relief is in several tens of feet to a few hundred feet.

Climate: *Average annual precipitation*—40 to 48 inches; highest in spring and early summer and low in midsummer. *Average annual temperature*—55° to 60° F. *Average freeze-free period*—180 to 200 days.

Water: Crops and pasture depend upon the moderate rainfall. Shallow wells or springs supply domestic needs and water for livestock on most farms, but deep wells are required to obtain large supplies. Water from deep wells is of good quality but hard. Small ponds on many individual farms provide some water for livestock, and a few large reservoirs are used for flood control and recreation.

Soil: *Red-Yellow Podzolic soils* (Baxter, Clarksville, Nixa, and Dickson, the latter two with fragipans) from deeply weathered cherty limestone occupy much of the area. Other members of this group are Talbott and Colbert soils from clayey limestones. *Reddish-Brown Lateritic soils* (Decatur) from relatively pure limestones and *Rendzinas* (Gasconade) from shaly limestones or calcareous clays are soils that are locally conspicuous but of small total extent. Small areas of soils like *Brunizems* are in small prairie outliers in the west.

117—Boston Mountains

Arkansas and Oklahoma
6,200 square miles

Land Use: About three-fourths of the area is in forest, mainly in farm woodlots but some in Arkansas in national forests. The remaining one-fourth of the area is about evenly divided between cropland and pasture. Corn, other grains, and hay for livestock feed are the main crops, and peach and apple orchards are important locally. Pastures are mostly of tame grasses and legumes but of native grasses on the prairie outliers in the west.

Elevation and Topography: 500 feet on the lowest valley floors to 2,500 feet on the highest ridge crests. Ridgetops of these deeply dissected sandstone and shale plateaus are narrow and rolling; valleys are narrow and steep sided and have steep gradients. Local relief is in a few hundreds of feet.

Climate: *Average annual precipitation*—45 to 52 inches; highest in spring and fall and lowest in midsummer. *Average annual temperature*—55° to 60° F. *Average freeze-free period*—180 to 205 days.

Water: The moderately high rainfall is adequate for crops and pastures. Shallow wells are the principal source of water for domestic use and livestock in the uplands. Small ponds on individual farms provide some water for livestock, and springs are numerous in the valleys. Deep wells are needed to obtain large supplies of ground water. Large reservoirs on several of the major streams are a source of municipal water and also provide flood control and recreation.

Soil: *Lithosols* (Montevallo, Ramsey, and Hector) and rough stony land on hilly to steep slopes are dominant in much of the area. *Red-Yellow Podzolic soils* (Hartsells, Linker, Allen, and Jefferson) are on the less sloping ridgetops, benches, and foot slopes; *Planosols* (Johnsburg and Tyler) on some flats with restricted drainage; and *Reddish Prairie soils* on prairie outliers in the west.

118—Arkansas Valley and Ridges

Arkansas and Oklahoma
7,000 square miles

Land Use: About one-half of the area is in forest; about one-third of the wooded area is Federally owned and most of the remainder is in farm woodlots. The other half of the area is one-third cropland and two-thirds pasture. Most of the cropland is on the less sloping land in the valleys but some is on flat mountain tops. Corn, cotton, soybeans, other feed grains, and hay are the major crops. Fruits and vegetables are important locally on the deeper soils throughout the area. Pastures are on the bottom land of small streams and throughout cleared parts of the uplands; they consist of mixtures of tame and native grasses and legumes.

Elevation and Topography: 300 feet on the lowest valley floors to 2,800 feet on some mountain tops. These ridges and valleys are underlain by slightly folded to level beds of sandstones and shales. Ridge slopes are steep; most crests are narrow and rolling but some are broad and flat. The intervening valleys are broad and smooth. Local relief is in several tens of feet in valleys and on the flat ridgetops. The ridges and mountains rise sharply hundreds of feet above adjacent valleys.

Climate: *Average annual precipitation*—44 to 50 inches; highest in spring and autumn. *Average annual temperature*—60° to 63° F. *Average freeze-free period*—200 to 240 days.

Water: The moderate rainfall is generally adequate for crops and pasture. In the uplands, water for domestic use is obtained mainly from shallow wells and water for livestock from small ponds on individual farms. In the valleys, springs, shallow wells, small ponds, and perennial streams provide water for most uses. Deep wells yield large amounts of hard water except in areas of shale bedrock where ground water is scarce.

Soil: *Lithosols* (Hector, Ramsey, and Montevallo) are dominant on hilly to steep ridges. *Red-Yellow Podzolic soils* (Linker, Hartsells, Enders, Monongahela, and Waynesboro) are extensive on level to rolling uplands and terraces. *Planosols* (Johnsburg and Wrightsville) are on level to gently rolling uplands and in clayey old alluvial deposits. *Alluvial soils* (Pope, Philo, and Stendal) on flood plains occupy about 10 percent of the area and are among the more important soils for crops.

119—Ouachita Mountains

Arkansas and Oklahoma
11,700 square miles

Land Use: Slightly more than four-fifths of the area is forested. Of this about one-fourth, mainly in Arkansas, is Federally owned. Some of the remainder is in large holdings, but much of it is in farm woodlots. Lumbering, wood-using industries, and recreational uses are important throughout the area. About 15 percent of the area is cropped or in pasture; the pasture acreage is a little larger than cropland acreage. Corn, oats, other feed grains, and hay for livestock feed are the main crops. Pastures are largely mixtures of tame grasses and legumes except on some small prairie outliers in the west where pastures are in native grasses.

Elevation and Topography: 300 feet on the lowest valley floors to 2,700 feet on the highest mountain peaks. These steep mountains are underlain by folded and faulted shales, slates, quartzites, sandstones, and novaculite. Most of the stream valleys are narrow and have steep gradients, but wide terraces and flood plains border the Ouachita River in western Arkansas. Local relief is a few hundred feet to more than 1,000 feet.

Climate: *Average annual precipitation*—Mainly 48 to 56 inches, decreasing to 35 inches along the western edge; fairly evenly distributed through the year but higher in spring and early autumn. *Average annual temperature*—60° to 62° F. *Average freeze-free period*—200 to 240 days.

Water: The high rainfall and many perennial streams provide abundant water. Several large reservoirs for water storage and flood control are used also for recreation. In the valleys spring and shallow wells are the main sources of water for domestic use and for livestock.

Soil: *Lithosols* (Goldston, Hector, Ramsey, and Montevallo) and rough stony land occupy most of the steep slopes throughout the area. *Red-Yellow Podzolic soils* (Georgeville, Herndon, Enders, and Wickham) are on the gentle slopes of ridgetops, benches, foot slopes, and old stream terraces and *Planosols* (Conway) on the gentle slopes of valleys underlain by shale. *Alluvial soils* (Congaree, Chewacla, and Pope) are on flood plains in some of the broader valleys and are among the most important agricultural soils.

120—Kentucky and Indiana Sandstone and Shale Hills and Valleys

Kentucky and Indiana
11,200 square miles

Land Use: Nearly all the area is in farms but about 5 percent is urban or in other uses. Strip mining for coal is an important industry. Slightly more than one-third of the area as a whole is cropland but the proportion is much higher in western Kentucky than elsewhere. Corn, soybeans, other feed grains, and hay for dairy cattle and other livestock are the principal crops. Tobacco is a major cash crop in places and apple and peach orchards are important on some farms, but the total acreage in these crops is small. About one-sixth of the area is in permanent pasture of tame and native grasses. About one-third is in forest, almost all in small and medium-sized farm woodlots.

Elevation and Topography: 400 feet on the lowest valley floors to about 800 feet on the highest ridgetops. The smoother parts of the gently rolling to hilly dissected sandstone and shale plateau have a thin to moderately thick loess cap. Valleys of the small streams are narrow, but the larger tributaries of the Ohio and Mississippi Rivers have wide flood plains. Local relief is mainly 100 to 200 feet, but some of the deeper valleys are several hundred feet below adjacent ridgetops. Strip mines, both operating and abandoned, are conspicuous features in many parts of the area.

Climate: *Average annual precipitation*—40 to 48 inches; fairly evenly distributed but slightly higher in spring and early summer and lowest from midsummer through autumn. *Average annual temperature*—55° to 58° F. *Average freeze-free period*—180 to 195 days.

Water: Rainfall is adequate for crops in most years but yields are reduced by drought in some years. Shallow wells provide water for domestic and livestock use on most farms but supplies are limited. Small farm ponds are an important source of livestock water. Deep wells yield large amounts of water, but the water is usually highly mineralized. The many perennial streams are potential water sources but they are not much used at present.

Soil: *Gray-Brown Podzolic soils* (Loring, Hosmer, and Grenada) from a thin to a moderately thick loess mantle over residuum from acid sandstones and shales are the dominant soils on the smooth flats and low hills in the northwest. In more dissected areas *Red-Yellow Podzolic soils* (Zanesville, Tilsit, and Christian) occupy level to rolling ridgetops; Zanesville and Tilsit soils have strongly expressed fragipans and some features of *Gray-Brown Podzolic soils.* On ridge slopes *Sols Bruns Acides* (Muskingum and Dekalb) and thin *Red-Yellow Podzolic soils* (Litz) are most extensive but rough stony land and strip-mine spoil are conspicuous in many places. *Alluvial soils* (Wakeland, Sharon, Falaya, and Huntington) are on broad flood plains, especially in western Kentucky, and are highly important to agriculture.

121—Kentucky Bluegrass

Kentucky, Indiana, and Ohio
11,000 square miles

Land Use: Most of the area is in farms but slightly less than one-third is cropland. Corn, other feed grains, and hay for livestock occupy the most acreage, but tobacco is an important cash crop in most of the area. About two-fifths of the area is in pasture, mainly bluegrass although some other tame grasses are also grown. Beef cattle are the principal livestock and race horses and sheep are important locally. About one-sixth of the area is in farm woodlots in poor condition. The remainder is in urban and miscellaneous uses.

Elevation and Topography: 800 to 900 feet in the central part and from 500 feet on valley floors to as much as 1,000 feet on the highest ridgetops in the shale and limestone hills. An undulating to rolling central limestone plain is surrounded by shale and limestone hills having narrow tops and steep sides. In the central part, local relief is mainly in a few feet to a few tens of feet. In the surrounding hills, relief is commonly 100 to 200 feet and in places as much as 500 feet.

Climate: *Average annual precipitation*—About 45 inches; highest in early spring, gradually decreasing through summer and autumn. *Average annual temperature*—About 55°F. *Average freeze-free period*—180 to 190 days.

Water: The moderate rainfall is adequate for crops in normal years, but yields are reduced by drought in some years. Cisterns and springs are important sources of water for domestic and livestock use. In some places deep wells supply large amounts of highly mineralized water. Recently small farm ponds have become an important source of water for livestock and other farm uses. A few large streams are potential sources of water but are not much used at present.

Soil: *Gray-Brown Podzolic soils* (Lowell, Shelbyville, Switzerland, Eden, Nicholson, Salvisa, and Hampshire) on rolling to hilly uplands underlain by calcareous rocks are the dominant soils. *Reddish-Brown Lateritic soils* (Maury) are important in deeply weathered phosphatic limestones. *Rendzinas* (Fairmont and Otway) are conspicuous on steep slopes underlain by soft limestone or highly calcareous shales.

122—Highland Rim and Pennyroyal

Kentucky, Tennessee, Indiana, and Alabama
22,700 square miles

Land Use: Most of the area is in farms; about 5 percent is Federally owned, and a small part is urban or in miscellaneous uses. About two-fifths is cropland. Corn, other feed grains, and hay for livestock feed occupy the largest acreage. Tobacco is an important cash crop and small acreages are used to grow vegetables and fruit, largely for home consumption. About one-sixth is in pasture of tame and native grasses and legumes. About one-third is in forest, mainly in farm woodlots but in large commercial holdings on the steeper land.

Elevation and Topography: 350 feet on valley floors to about 1,000 feet on the highest ridgetops. This is a dissected limestone plateau. There are some smooth sections in the central and eastern parts, but much of the area, particularly in the west, consists of narrow rolling ridgetops, hilly and steep ridge slopes, and narrow valleys. The smooth parts have relief of only a few feet to one or two tens of feet, but the dissected areas have relief of one to several hundred feet.

Climate: *Average annual precipitation*—45 to 54 inches; highest in midwinter and early spring, gradually decreasing from spring to midautumn. *Average annual temperature*—55° to 60° F. *Average freeze-free period*—180 to 200 days.

Water: Rainfall is adequate for crops in many years, but yields are reduced in the occasional years of drought. Shallow wells, streams, and springs are the principal sources of water for livestock and domestic use in the more dissected parts, and ponds and cisterns are important sources in the smoother uplands.

Wells supply an abundance of highly mineralized ground water. Multipurpose dams on the Tennessee and Cumberland Rivers provide flood control and electric power. The reservoirs also serve as waterways for transportation and recreation.

Soil: *Red-Yellow Podzolic soils* are dominant throughout the area. In thinly loess mantled residuum from limestone Pembroke, Crider, Mountview, Russellville, Dickson, and Bedford (the latter three having fragipans) are representative soils. On rolling to hilly slopes Baxter and Frankstown soils from cherty limestone residuum and Christian soils from mixed sandstone, limestone, and shale are the major soils. *Regosols* (Bodine) from very cherty limestone and *Lithosols* (Montevallo and Colyer) from acid shales, mostly along the northern and eastern border, are the principal soils on steep slopes. *Alluvial soils* (Ennis, Lindside, and Huntington) are of small total extent but are among the most important agricultural soils, especially in the more dissected parts of the area.

123—Nashville Basin

Tennessee
5,700 square miles

Land Use: Nearly all the area is in farms and about two-fifths is cropland. Grain and hay for livestock are the principal crops. Beef cattle are the major livestock, but dairying is important near the larger towns and cities. About one-third of the area is in pasture of tame grasses and legumes. About one-fourth is in forest, nearly all in farm woodlots.

Elevation and Topography: 400 feet on valley floors to 1,000 feet in the hills. The central part of the area is a gently rolling to hilly limestone plain, but the outer margins are deeply dissected and have steep slopes. In the central part relief is in a few tens of feet to about 100 feet.

Climate: *Average annual precipitation*—About 50 inches; highest in midwinter, decreasing from midspring to midautumn. *Average annual temperature*—58° to 60° F. *Average freeze-free period*—180 to 200 days.

Water: The moderately high rainfall provides water for crops and pasture, but frequent summer droughts damage pastures and lower crop yields. Ground water from springs and wells is the main source of water for domestic and livestock use. Yields from wells vary and the water is highly mineralized. Farm ponds provide water for livestock in many places. The small streams fluctuate in flow and many of them are dry in summer. A few large perennial streams are important water sources, and the Cumberland River has dams for flood control, power production, and navigation.

Soil: *Reddish-Brown Lateritic soils* (Maury and Decatur) and associated *Red-Yellow Podzolic soils* (Talbott, Pembroke, and Colbert) all from limestone materials are extensive. Many of the soils in this area have somewhat darker colored surface layers than are considered normal for these great soil groups. Associated with them are *Lithosols* (Inman) and large areas of limestone rockland. *Gray-Brown Podzolic soils* (Mimosa, Armour, and Dellrose) from phosphatic and argillaceous limestone are extensive on the dissected outer borders of the area. *Alluvial soils* (Lindside and Huntington) on flood plains are of small total extent but are highly important to agriculture.

124—Western Allegheny Plateau

Ohio
8,200 square miles

Land Use: Most of the area is in farms but about one-fourth is in other uses. About one-fifth is cropland. Hay and feed grains for livestock are the principal crops, and fruits and vegetables are important locally. About one-fifth is in pasture and tame grasses and legumes. Two-fifths is in forest, about half of which is in farm woodlots and about half in State and National forests and large commercial holdings. Strip mining of coal is important in the north, but only a small part of the total area is in this use.

Elevation and Topography: 650 feet on the lowest valley floors to 1,300 feet at the highest ridgetops. The dissected sandstone plateau has narrow level valley floors, rolling ridgetops, and hilly to steep ridge slopes. Local relief is one to several hundred feet.

Climate: *Average annual precipitation*—40 to 45 inches; evenly distributed except for a slight maximum in late spring and a minimum in late autumn. *Average annual temperature*—48° to 55° F. *Average freeze-free period*—Mainly 140 to 160 days but 180 days along the southern edge.

Water: The moderate rainfall and many perennial streams supply an abundance of water. Shallow wells and springs are the principal water sources for domestic and livestock use. Deep ground water is abundant but is highly mineralized. Reservoirs on many streams provide water for industrial and municipal use for most of the cities within the area and also for some cities in adjoining areas.

Soil: *Gray-Brown Podzolic soils* (Gilpin, Hanover, Keene, and Wellston) are the principal soils on rolling ridgetops and *Sols Bruns Acides* (Muskingum) on the somewhat less extensive strongly rolling to steep slopes. *Alluvial soils* (Chagrin and Lobdell) on narrow flood plains are of small total extent but are the best agricultural soils of the area.

125—Cumberland Plateau and Mountains

Kentucky, Tennessee, and West Virginia
25,900 square miles

Land Use: Almost all the forest, which covers about four-fifths of the area, is privately owned, mainly in small individual holdings but partly in large tracts owned by mining and timber companies. A small part is in Cumberland National Forest. Coal mining, both strip mining and shaft mining, is the major industry in the area. About 5 percent of the area is cropland and a slightly smaller amount is in pasture. Most of the farmland is on the undulating to rolling plateau top but there is a little in the narrow valleys. Corn, other grains, and hay for livestock feed are the principal crops; many vegetables and fruits are grown for home use. Tobacco is an important cash crop on many farms, mainly in Kentucky. Commercial po-

tato and vegetable production is locally important in Tennessee. Most farms are part-time enterprises, and the operators obtain much of their livelihood from off-farm employment.

Elevation and Topography: 1,000 feet at the base of escarpments that border the plateau to 2,000 feet on the plateau top, some mountains along the eastern margin 2,500 feet and a few 3,500 feet. The deeply dissected sandstone and shale plateau has steep and very steep slopes separated by narrow level valleys; ridgetops are narrow and rolling. In the south there are some flat plateau remnants and some mountain ranges that rise above the general plateau level. Local relief is mostly in several hundreds of feet and in places more than a thousand feet. Broader plateau remnants in the south have relief of only a few tens of feet to 100 or 200 feet.

Climate: *Average annual precipitation*—42 to 56 inches, increasing from north to south; highest in winter and early spring and lowest in autumn. *Average annual temperature*—55° to 60° F. *Average freeze-free period*—170 to 200 days, increasing from north to south.

Water: Water is abundant in the area. Water for domestic and livestock use is obtained from wells, springs, and cisterns. Deep ground water is generally highly mineralized. The large perennial streams are potential water sources that are not much used at present, but a few reservoirs provide water for municipal and industrial use. The small streams flow intermittently, and most of them are dry during summer and autumn.

Soil: *Sols Bruns Acides* (Muskingum and Dekalb) and *Lithosols* (Ramsey, Weikert, and Montevallo) are the principal soils on hilly and steep slopes throughout the area. Closely associated with them are many small areas of rough stony land and rock outcrop. *Gray-Brown Podzolic soils* (Willston and Gilpin) are on the undulating and rolling plateau slopes in the north and *Red-Yellow Podzolic soils* (Hartsells, Clymer, and Jefferson) on smooth plateau tops and on foot slopes in valleys, mostly in the south. The total area of these soils is not large, but they are important to agriculture. *Alluvial soils* (Pope and Philo) on flood plains in narrow valleys are other important agricultural soils.

126—Central Allegheny Plateau

West Virginia, Pennsylvania, and Ohio
19,400 square miles

Land Use: Most of the area is in farms; about 10 percent is urban or in other uses. Recently much farmland along the Ohio River has been diverted to industrial uses. About one-sixth of the area is cropland and about one-fifth is in pasture. Hay and some grain for dairy cattle and other livestock are the major crops, but locally many fruits and vegetables are grown in small areas for home consumption. Nearly half the area is in forest, and the sale of timber is an important source of income on some farms. Leasing land for strip mining of coal is another important source of income for many farm owners.

Elevation and Topography: 600 feet on the lowest valley floors to 1,300 feet at the highest ridgetops and higher in many places in the southeast. The dissected plateau is underlain by sandstones and shales and some layers of calcareous rocks. Level narrow valleys and narrow rolling ridgetops are separated by long steep ridge slopes. Local relief is in hundreds of feet.

Climate: *Average annual precipitation*—35 to 45 inches; somewhat unevenly distributed; highest in midsummer and lowest in autumn and early winter. *Average annual temperature*—50° to 55° F. *Average freeze-free period*—160 days.

Water: Water is plentiful in the area. Water for domestic and livestock use is obtained from springs, shallow wells, small farm ponds, and cisterns. A large amount of ground water can be obtained from deep wells, but drilling is expensive and the water is highly mineralized. The Ohio River and its major tributaries have been developed for navigation by low dams and locks. The smaller streams have been little used as a water resource. Pollution of streams by wastes from coal mines is a serious problem.

Soil: *Sols Bruns Acides* (Muskingum) and *Gray-Brown Podzolic soils* (Gilpin), both derived from interbedded sandstones and shales and mainly on steep slopes, are the dominant soils of the area. Associated with them on steep slopes underlain by calcareous shales and limestones are *Gray-Brown Podzolic soils* (Upshur, Belmont, Westmoreland, and Guernsey). Upshur soils occur in complexes with Gilpin and Muskingum soils over much of the area. Another *Gray-Brown Podzolic soil* (Wheeling) on terraces of the Ohio River is an important agricultural soil now being converted rapidly to urban and industrial uses. On gently sloping to rolling ridgetops underlain by clay shales *Red-Yellow Podzolic soils* (Cavode and Wharton) are conspicuous but of small total extent. *Alluvial soils* (Huntington and Lindside) occupy the broad flood plains of the Ohio River and its larger tributaries and are important agricultural soils. Along many of the smaller tributary streams Pope and Philo soils, also *Alluvial soils*, are extensive.

127—Eastern Allegheny Plateau and Mountains

Pennsylvania, West Virginia, and Maryland
15,900 square miles

Land Use: Most of the area is in farms; about 15 percent is in other uses. About three-fourths is in forest, mainly in small privately owned holdings, but about one-tenth is in national forest and additional areas are in large holdings. Lumbering and wood-using industries are important. The oldest gas and oil fields in the United States are in the area, and coal mining is an important industry in places. About one-tenth of the area is cropland and an even smaller percentage is in pasture. Hay and other feed for dairy cattle are the major crops; small acreages are in fruits and vegetables, grown mainly for home consumption.

Elevation and Topography: 1,000 feet in the lowest valleys to 2,000 to 2,500 feet over much of the plateau top, mountains in the southeast 3,500 to 4,500 feet. This deeply dissected plateau terminates in a high escarpment on the east. Steep slopes are dominant but level to gently rolling plateau remnants are conspicuous in the north. Local relief is mainly in hundreds of feet, but some mountain peaks in the south rise 1,000 feet or more above the plateau or adjacent valleys.

Climate: *Average annual precipitation*—40 to 60 inches, increasing from north to south; highest from early spring through late summer and lowest in autumn and early winter. *Average annual temperature*—47° to 50° F. *Average freeze-free period*—120 to 170 days, increasing from north to south.

Water: Water is abundant. Domestic and livestock needs are supplied from shallow wells, springs, cisterns, and farm ponds. Ground water is scarce in the areas underlain mostly by shales; elsewhere it is plentiful but highly mineralized. The many perennial streams are potential water sources that are little used at present.

Soil: *Sols Bruns Acides* (Dekalb, Calvin, and Lehew) from acid gray sandstones and red shales are the dominant soils on the extensive steep slopes. Associated with them are *Gray-Brown Podzolic soils* (Gilpin and Belmont) also from shales, those under Belmont being red and calcareous. *Red-Yellow Podzolic soils* (Clymer, Cookport, Wharton, and Cavode) from acid sandstone and shale materials are on level to rolling ridgetops and *Alluvial soils* (Pope and Philo) and *Low-Humic Gley soils* (Atkins) on flood plains of the larger streams.

128—Southern Appalachian Ridges and Valleys

Virginia, West Virginia, Tennessee, Georgia, and Alabama
28,600 square miles

Land Use: About three-fourths of the area is in farms, about one-twelfth is owned by the Federal Government, 1 or 2 percent is urban, and the remainder is in other uses. About one-half of the area is in forest, mainly small to medium-sized farm woodlots. Most of the Federally owned land is in national forests or national parks that are also wooded or in watershed-protection areas bordering Tennessee Valley Authority lakes and other reservoirs. About one-sixth is cropland and an equal amount is in pasture. Feed and forage crops for livestock occupy the largest acreage, but cotton in Georgia and Alabama and tobacco in the remainder of the area are important cash crops. Many vegetables and fruits are grown for home consumption throughout the area. Beef cattle are the principal livestock but dairying is important near the larger cities. Many of the farms in the area are small and give only part-time employment to the occupants.

Elevation and Topography: In valleys 600 feet in the southwest to more than 1,000 feet in the north; highest ridgetops 2,000 to 3,000 feet, rising gradually from south to north, and a few mountains in the north 4,000 feet or more. Northeast-southwest-trending valleys underlain mainly by limestones and shales are separated by steep ridges or mountains underlain mainly by sandstones and shales. Valleys are undulating to strongly rolling or hilly with local relief of a few tens to a few hundreds of feet. Ridges and mountains are mainly steep and rise several hundred to more than a thousand feet above adjacent valleys.

Climate: *Average annual precipitation*—35 to 55 inches, increasing from north to south; highest in midwinter and midsummer and least in autumn. *Average annual temperature*—50° to 60° F., decreasing from south to north. *Average freeze-free period*—160 to 220 days, decreasing from south to north.

Water: Crops and pasture depend almost entirely on rainfall for moisture, and reduced yields due to late summer and autumn droughts are common. Domestic and livestock needs are supplied by shallow wells, springs, ponds, and cisterns. In most areas underlain by limestone ground water is abundant but highly mineralized. Shale areas have small ground-water supplies and depend mainly on surface water and rainfall. Small streams vary in flow and most of them are dry in summer and autumn except immediately after storms. Major rivers have many dams for flood control, navigation, and power production and also provide recreation.

Soil: *Red-Yellow Podzolic soils* (Fullerton, Clarksville, Dunmore, Talbott, Colbert, Dewey, Sequoia, and Jefferson) are dominant in valleys throughout the area. Associated with them, mainly in materials from noncherty limestone, are *Reddish-Brown Lateritic soils* (Decatur, Cumberland, Tellico, and Neubert). On steeply sloping sandstone and shale ridges *Sols Bruns Acides* (Muskingum, Berks, and Lehew) and *Lithosols* (Ramsey, Montevallo, and Dandridge) are the principal soils. *Alluvial soils* (Huntington, Lindside, Newark, Pope, Stendal, and Philo) on narrow flood plains are of small total extent but are highly important to agriculture.

129—Sand Mountain

Alabama
8,700 square miles

Land Use: Most of this area is in farms; about 10 percent is urban or in other uses. About three-fifths is in forest, mainly in farm woodlots or other small holdings but some in large commercial holdings. Less than one-fifth of the area is cropland. Cash cropping of cotton and corn is the main farm enterprise but vegetables, fruits, and potatoes are grown also. Less than one-tenth of the area is in pasture. Only a few livestock are raised and most of the livestock products are consumed on the home farm.

Elevation and Topography: 500 feet at the base of plateau escarpments to 1,000 feet at the plateau top, one or two mountain peaks 1,500 feet. The sandstone plateau has an undulating to rolling top but it is deeply dissected and steep along the margin. Local relief is in several tens of feet to one or two hundred feet on the plateau top, but the adjoining lowlands are several hundred feet below the plateau summit.

Climate: *Average annual precipitation*—About 54 inches; somewhat unevenly distributed; highest in midwinter, decreasing gradually from spring to autumn except slightly higher in midsummer. *Average annual temperature*—60° to 62° F. *Average freeze-free period*—Mainly 200 to 210 days and 240 days in some valleys.

Water: The plentiful rainfall is adequate for crops and pasture in most years. Droughts are less frequent and of shorter duration than in adjoining valleys. Water for livestock is available from streams, springs, and ponds. Shallow wells yield only small and uncertain amounts of water but deep wells yield large amounts and are dependable. Most streams flow intermittently and are dry in summer and autumn except after storms.

Soil: *Red-Yellow Podzolic soils* (Hartsells and Albertville) are the principal soils on the smooth plateau top. Associated with them are *Sols Bruns Acides* (Crossville). *Lithosols* (Ramsey) occupy steep mountain sides and valley walls.

130—Blue Ridge

North Carolina, Virginia, Georgia, Tennessee, South Carolina, and Maryland
18,900 square miles

Land Use: Two-thirds or more of the area is in forest, much of which is privately owned. About a fifth of the area is in national parks and forests, but the proportion is much higher in Georgia and Tennessee. About one-tenth of the area, mainly on small farms in valleys and coves, is cropland and one-sixth is in pasture. Corn and hay are the most extensive crops; small grains, potatoes, and many kinds of fruits and vegetables are grown also. Tobacco is an important crop in some places. Most of the farms are part-time enterprises, and the occupants earn a large part of their livelihood elsewhere.

Elevation and Topography: 1,000 feet in the lower valleys and foot slopes to more than 6,500 feet in the mountains along the Tennessee-North Carolina boundary, decreasing gradually both north and south from this high point. The rugged mountains have steep slopes and sharp crests, and they are dissected by steep narrow valleys. Local relief is in several hundreds to a few thousands of feet.

Climate: *Average annual precipitation*—Mainly 40 to 50 inches but as much as 80 inches on highest peaks in the south; somewhat unevenly distributed; highest in midsummer and midwinter and least in autumn. *Average annual temperature*—50° to 60° F. *Average freeze-free period*—150 to 220 days, decreasing in length with increasing elevation and from south to north.

Water: Springs and shallow wells provide domestic water, but the ground-water yield from wells is generally small. Water for livestock comes largely from springs and perennial streams though some farm ponds have been built recently. In the southern two-thirds of the area the major rivers have many dams for flood control and electric-power production and are used for recreation.

Soil: On steep mountain slopes *Lithosols* (Talladega, Chandler, and Ramsey) and *Sols Bruns Acides* (Ashe and Ranger) are the principal soils. *Gray-Brown Podzolic soils* (Porters) are in the more deeply weathered material on some of the less sloping mountain sides. Rough stony land and rock outcrops are conspicuous on mountain slopes but their total area is small. In more deeply weathered residuum and in colluvium, especially at lower elevations, *Red-Yellow Podzolic soils* (Hayesville, Balfour, Tusquitee, and Tate) are extensive; associated with them on basic rocks are *Reddish-Brown Lateritic soils* (Rabun and Clifton). *Alluvial soils* (Congaree and Chewacla) are on narrow flood plains of the many stream valleys.

O—MISSISSIPPI DELTA COTTON AND FEED GRAINS REGION

45,600 square miles

This region consists of the flood plains and terraces of the Mississippi River south of its confluence with the Ohio River. The average annual precipitation ranges from 45 to 65 inches. Average annual temperatures are 58° to 70° F., and the freeze-free season is 200 to 280 days.

Low-Humic Gley soils, Humic Gley soils, Alluvial soils, and Grumusols are the extensive soils on flood plains and low terraces. Red-Yellow Podzolic soils are important on the higher silt-mantled terraces.

The soils throughout much of the region are naturally poorly drained and poorly suited to crops, but if they are artificially drained, they are highly productive of many crops. Cotton, soybeans, corn, and hay are grown throughout the region. Rice in Arkansas and Louisiana and sugarcane in Louisiana are important crops locally. The wettest areas that are not artificially drained remain in forests, which are important for hardwood-timber production.

131—Southern Mississippi Valley Alluvium

Arkansas, Mississippi, Louisiana, Missouri, and Tennessee
36,600 square miles

Land Use: Nearly all the area is in farms. For the area as a whole, about 10 percent is in woodland and the remainder is evenly divided between cropland and pasture. But the proportion of cropland is nearly three-fourths in the north and less than one-fourth in the south. The amount of land in forest varies inversely with that in crops; the amount in pasture is a little higher in the south. This is an important cash-crop area. Cotton, corn, and soybeans grown by highly mechanized methods are major crops throughout the area. Rice is an important crop in Arkansas and Louisiana and sugarcane in southern Louisiana.

Elevation and Topography: Sea level in the south, increasing gradually to about 500 feet in the north. The area consists of nearly level to gently sloping broad flood plains and low terraces. Most of the area is flat. The only noticeable slopes are sharp terrace scarps and natural levees that rise sharply a few feet to several tens of feet above adjacent bottom lands or stream channels.

Climate: *Average annual precipitation*—45 to 65 inches, increasing from north to south; over most of the area highest in winter and early spring, decreasing gradually to a minimum in autumn; along the Gulf Coast highest in midsummer and early autumn. *Average annual temperature*—58° to 70° F., increasing from north to south. *Average freeze-free period*—200 to 280 days, increasing from north to south.

Water: Rainfall, streamflow, and ground water supply an abundance of water. Surplus water is a serious problem on many of the soils, and artificial drainage is required before they can be used successfully for crops. The Mississippi River crosses the area from north to south and many of its tributaries also cross the area. Oxbow lakes and bayous are extensive throughout.

Soil: *Grumusols* (Sharkey, Alligator, Tunica, and Perry) formed in clayey alluvium are the most extensive. *Alluvial soils* (Commerce, Mhoon, and Robinsonville) are also important, and Adler soils from local alluvium lie at the foot of the adjoining bluffs in many places. *Low-Humic Gley soils* (Forestdale and Waverly) and *Humic Gley soils* (Jeanerette) are conspicuous on low terraces. On some of the older terraces *Gray-Brown Podzolic soils* (Dundee, Dubbs, and Bosket) are the major soils.

132—Eastern Arkansas Prairies

Arkansas
7,000 square miles

Land Use: Most of the area is in farms, but about 10 percent is urban or in other uses. About one-half is cropland and only a small amount is in pasture. Rice is the major crop in this cash-crop area. Cotton, corn, and soybeans are other important crops. About one-third of the area is in forest.

Elevation and Topography: 150 to 300 feet. Nearly level broad terraces are crossed by meandering streams having shallow valleys. The terraces terminate in short steep escarpments, and natural levees one to several tens of feet high border the stream channels. Elsewhere local relief is in only a few feet.

Climate: *Average annual precipitation*—About 50 inches; highest in winter and spring, decreasing through summer to a minimum in autumn. *Average annual temperature*—About 63° F. *Average freeze-free period*—About 220 days.

Water: Rainfall, ground water, and streamflow provide an abundance of water. Water for rice irrigation is stored in many artificial ponds and reservoirs, and water from wells is also used for this purpose. Except for rice, artificial drainage is required for the successful production of most crops. The many lakes and ponds, both natural and artificial, provide excellent hunting and fishing.

Soil: *Planosols* (Crowley) from fine-textured sediments on level terraces are the dominant soils. On better drained and less clayey materials *Gray-Brown Podzolic soils* having a fragipan (Grenada) are the major soils.

P—SOUTH ATLANTIC AND GULF SLOPE CASH CROP, FOREST, AND LIVESTOCK REGION

250,200 square miles

This cotton-growing region consists of the gently sloping to rolling southern Piedmont and upper Coastal Plain. The average annual precipitation ranges from 40 to 60 inches; rainfall is considerably higher in midsummer than in the rest of the year. Average annual temperatures are 60° to 68° F. over most of the area but are as low as 57° F. in some of the higher parts and as high as 71° F. in the extreme southeast. The freeze-free season is 200 days or more in most of the region and as long as 300 days in the southernmost part.

Red-Yellow Podzolic soils are dominant throughout the region. Reddish-Brown Lateritic soils from basic rocks are conspicuous locally as are Grumusols from marls or soft limestones. Alluvial soils on flood plains of the major streams are among the better soils for crops.

Cotton is the main cash crop throughout the region, but cotton acreage has been declining for many years. Peanuts and tobacco are also important, especially in the northeast. The acreage in improved pasture has been increasing, and much of the more sloping land is being returned to forest.

133—Southern Coastal Plain

Georgia, Alabama, Mississippi, Louisiana, Texas, Arkansas, Tennessee, North Carolina, South Carolina, Virginia, and Florida
145,300 square miles

Land Use: Nearly all the area is in farms. A small acreage is owned by the Federal Government, and additional small areas are urban or in other uses. Between one-half and three-fourths is woodland, nearly all in small holdings but some in large tracts. The proportion of woodland is greatest in the west. Lumber, pulpwood, and naval stores are the major forest products. Between one-tenth and one-third is cropland; the largest acreage is in the east. Less than one-tenth is in pasture. This is a cash-crop area, and cotton is a major crop. Peanuts, tobacco, melons, various vegetable crops, and corn are important also. The trend recently is to more pasture and woodland and less cropland.

Elevation and Topography: 100 to 600 feet, increasing gradually from the lower Coastal Plain to the Piedmont. The gently to strongly sloping dissected coastal plain is underlain by unconsolidated sands, silts, and clays. In their upper reaches stream valleys are narrow, but the lower parts of the valleys are broad and have widely meandering stream channels. Local relief is mainly in a few tens of feet, but some of the more deeply dissected parts have relief of 100 to 200 feet.

Climate: *Average annual precipitation*—40 to 60 inches; lowest in autumn throughout the area and highest in midsummer in the east and in winter and spring in the west. *Average annual temperature*—60° to 68° F., increasing from north to south. *Average freeze-free period*—200 to 280 days, increasing from north to south.

Water: Rainfall, many perennial streams, and ground water provide an abundance of water. Even though summer rainfall is fairly high, droughts are common and then good returns are obtained from irrigation on all but the wettest soils. Drainage is necessary before the wet lowlands can be used for crops. Domestic water supplies are obtained mainly from shallow wells and water for livestock from perennial streams and small farm ponds. The many perennial streams are potential water sources that have been little used in most of the area.

Soil: *Red-Yellow Podzolic soils* are dominant throughout (Ruston, Norfolk, Orangeburg, Saffell, and Lexington from sandy or gravelly materials; Marlboro, Bowie, Savannah, Shubuta, Kirvin, and Silerton from medium to moderately fine textured materials; and Boswell, Susquehanna, Sawyer, and Cuthbert in fine-textured materials). Associated with them on wet lowlands are *Low-Humic Gley soils* (Plummer, Bladen, Bibb, Falaya, and Coxville) and *Humic Gley soils* (Portsmouth, Bayboro, Weeksville, and Johnston). *Reddish-Brown Lateritic soils* (Greenville, Red Bay, and Nacogdoches) are important locally, mainly in the south, but are of small total extent. *Regosols* (Eustis, Lakeland, and Kershaw) are on gently rolling to steeply sloping areas underlain by sands. *Alluvial soils* (Mantachie and Iuka) on narrow bottom lands are important to agriculture locally; in Texas and Louisiana, where the alluvium contains a large amount of material from red rocks, Miller and Yahola are important soils.

134—Southern Mississippi Valley Silty Uplands

Mississippi, Tennessee, and Kentucky
24,000 square miles
Louisiana and Arkansas
2,000 square miles

Land Use: Most of the land is in farms, a small amount is Federally owned, and other small areas are urban or in other uses. About a third of the whole area is cropland but the amount of cropland varies

greatly from county to county, depending on soils and topography. This is largely a cash-crop area. Cotton, corn, and soybeans are major crops, but rice is important locally in Arkansas and strawberries in Louisiana. Feed grains and forage are grown on dairy farms, mainly near the larger towns and cities. Only about a tenth of the area is in pasture, but the present trend is to a moderate increase in land in pasture. About one-fourth is in forest. Lumber is the major forest product and some pulpwood is harvested.

Elevation and Topography: 100 to 600 feet. The sharply dissected plains have a thick loess mantle, which is underlain by unconsolidated sands, silts, and clays, mainly of marine origin. Valley sides are hilly to steep, especially in the west. The intervening ridges are mostly narrow and rolling, but some of the interfluves between the upper reaches of the valleys are broad and flat. Stream valleys are narrow in their upper reaches but broaden rapidly downstream and have wide flat flood plains and meandering stream channels. Local relief is mainly in several tens of feet to 100 or 200 feet.

Climate: *Average annual precipitation*—46 to 60 inches, increasing from north to south; highest in winter and spring, decreasing gradually through summer to autumn except for a moderate increase in midsummer. *Average annual temperature*—60° to 68° F., increasing from north to south. *Average freeze-free period*—200 to 280 days, increasing from north to south.

Water: Rainfall and ground water are abundant. In the uplands shallow wells, cisterns, and ponds are the main water sources for domestic use and livestock. Shallow wells provide only small amounts of water but deep wells in the underlying sands and gravels yield large amounts. Most streams in the area are small and flow intermittently. They flow most of the time in winter and spring but only during and immediately after storms in summer and autumn.

Soil: *Gray-Brown Podzolic soils* (Memphis, Loring, and Grenada) that formed in thick loess on gently rolling to hilly uplands and terraces are the dominant soils. On associated level areas *Planosols* (Calloway and Henry) are conspicuous. All these soils except Memphis have a strongly expressed fragipan. In the east, where the loess mantle thins, *Red-Yellow Podzolic soils* (Lexington, Brandon, Providence, Lax, and Silerton) are the major soils. *Alluvial soils* (Vicksburg, Collins, and Mantachie) and *Low-Humic Gley soils* (Waverly, Falaya, and Bibb) on the broad flood plains in the west are some of the most important agricultural soils. Small areas of *Solonetz soils* (Lafe, Foley, and Verdun) are conspicuous, especially in Louisiana.

135—Alabama and Mississippi Blackland Prairies

Alabama and Mississippi
9,000 square miles

Land Use: Most of the land is in farms but a small amount is urban or in other uses. Slightly less than one-fifth is cropland. This is a cash-crop area; cotton, soybeans, and corn are the main crops. Some hay and small grains are grown also. A little more than one-fourth of the area is in pasture grazed mostly by beef cattle. The trend recently is to an increase in pasture acreage and a decrease in cropland. About two-fifths is in forest, nearly all in farm woodlots.

Elevation and Topography: 100 to 300 feet, a few hills 500 feet. The dissected uplands are underlain by clays, marls, and chalk. Slopes are nearly level to gently rolling. Local relief is mainly in a few feet to a few tens of feet. Large streams have broad level relatively shallow valleys.

Climate: *Average annual precipitation*—48 to 56 inches; highest in early winter, spring, and midsummer, lower in early summer, and least in autumn. *Average annual temperature*—60° to 65° F., decreasing from south to north. *Average freeze-free period*—230 to 260 days.

Water: Rainfall and perennial streams are important water sources, but ground water from moderately deep and deep wells is the principal source for both domestic and municipal uses. Many ponds provide water for livestock and also serve for recreation. Some of the perennial streams are potential water sources but are not much used at present.

Soil: *Red-Yellow Podzolic soils* (Oktibbeha and Vaiden) from acid clays are the dominant soils at the highest elevations. *Grumusols* (Houston and Brooksville) are on the smooth parts of uplands underlain by marl and chalk and *Rendzinas* (Binnsville and Sumter) are on the more sloping parts. *Alluvial soils* (Leeper, Catalpa, and Kaufman) are on broad flood plains and *Low-Humic Gley soils* (Tuscumbia and Una) and wet *Grumusols* (West Point and Eutaw) on poorly drained flats of both uplands and flood plains.

136—Southern Piedmont

Virginia, North Carolina, South Carolina, Georgia, and Alabama
59,000 square miles

Land Use: Most of the land is in farms, a small amount is Federally owned, and other small areas are urban or in other uses. Only about a fifth of the area is cropland. This is a cash-crop area; cotton is the major crop although tobacco is important in the northern one-third. Corn, grain sorghum, small grains, and hay are other important crops. Less than a tenth of the area is in pasture. The trend recently has been to an increase in livestock farming and dairying, accompanied by an increase in pasture acreage and a decrease in cropland. About three-fifths is in forest, mostly in farm woodlots, but a few large areas are in national forests and other large holdings. Pulpwood is the major forest product, but hardwood and pine lumber is also important.

Elevation and Topography: 300 to 1,000 feet, increasing gradually from east to west. This dissected plateau is underlain mostly by schists, gneisses, and granites and by some basic crystalline rocks, sandstones, and slates. Topography is gently rolling to hilly and stream valleys are narrow. Local relief

is mainly in several tens of feet to 100 or 200 feet, but some foothills in the west have relief of several hundred feet.

Climate: *Average annual precipitation*—45 to 55 inches; evenly distributed through the year except slightly higher in midsummer. *Average annual temperature*—57° to 65° F. *Average freeze-free period*—200 to 250 days, decreasing from south to north and with elevation.

Water: Rainfall and perennial streams are the major sources of water. Ground-water supplies are small, but shallow and deep wells are the principal water sources for domestic use. Streams, springs, and many small ponds are the important sources of livestock water. The potentially large water supplies from perennial streams are not much exploited at present. Small streams are dry during most of summer and autumn except immediately after storms.

Soil: *Red-Yellow Podzolic soils* are dominant (Cecil, Appling, and Madison from acid crystalline rocks; Lloyd and Enon from less acid crystalline rocks; Georgeville, Herndon, and Alamance from slates; and Mayodan, Wadesboro, and Granville from Triassic sandstones and shales). *Reddish-Brown Lateritic soils* (Davidson and Mecklenburg) are on uplands underlain by basic crystalline rocks and *Planosols* (Iredell and Elbert) are associated with them on foot slopes or wet upland flats. Shallow *Sols Bruns Acides* (Louisa, Louisburg, Brandywine, and Wilkes) are on strongly rolling to steep slopes throughout the area.

137—Carolina and Georgia Sand Hills

Georgia, South Carolina, and North Carolina
8,200 square miles

Land Use: Most of the area is in farms; about one-sixth is owned by the Federal Government and is used for military posts and training areas. Additional small parts are urban or in other uses. Nearly three-fifths of the area is in forest of scrub oak and pine. Pulpwood and some lumber are the principal forest products. About one-fifth of the area is cropland and only a very small amount is in pasture. Corn and cotton are the principal crops. Most of the farms are part-time or subsistence farms.

Elevation and Topography: 200 to 500 feet, increasing gradually from south to north. The area is a dissected rolling to hilly upland. In many of the more dissected areas there are stabilized dunes, resulting in very irregular slopes. Local relief is mainly in tens of feet, but a few hills are 100 or 200 feet above adjacent areas.

Climate: *Average annual precipitation*—45 to 50 inches; highest in midsummer and least in autumn. *Average annual temperature*—62° to 65° F. *Average freeze-free period*—220 to 240 days.

Water: Rainfall, perennial streams, and ground water supply an abundance of water. The kind and amount of plant growth is severely limited by low moisture in the rapidly permeable soils that are dominant in this area.

Soil: *Regosols* in deep sands and gravels (Lakeland, Eustis, and Kershaw) on rolling to hilly slopes are dominant. *Red-Yellow Podzolic soils* (Gilead, Vaucluse, Norfolk, Cuthbert, and Hoffman) occur where the upper sandy strata are underlain by more clayey material and are the soils used from crops.

138—North Central Florida Ridge

Florida
4,000 square miles

Land Use: Most of the land is in farms but some large holdings are used for grazing and forestry. About one-fourth of the area is cropland and an additional 5 to 10 percent is in pasture. Corn, peanuts, tobacco, vegetables, and melons are major crops. Tung orchards are important in places. Some hay and feed grains are grown for livestock, and the trend is to an increase in these crops and in pasture. More than one-half of the area is in forest, a large part of which is used as range for cattle. Lumber, pulpwood, and naval stores are other forest products.

Elevation and Topography: 50 to 200 feet. The sand-mantled limestone upland has irregular gently rolling topography. Many limestone sinks, some filled with water, dot the area. There are a few streams. Local relief is in a few feet to a few tens of feet.

Climate: *Average annual precipitation*—50 to 55 inches; lowest in winter, increasing slightly in spring, and highest in summer and early autumn. *Average annual temperature*—68° to 71° F. *Average freeze-free period*—280 to 300 days.

Water: The abundant rainfall and ground water are the principal water sources. Shallow and deep wells provide water for domestic and livestock use and are also used as a source of irrigation water. The many lakes and ponds are used for recreation.

Soil: *Regosols* (Fort Meade, Eustis, Blanton, Lakeland, Orlando, and Gainesville) from deep sands are the dominant soils over much of the area. In some places, mainly in the south, where sands are underlain by more clayey materials *Red-Yellow Podzolic soils* (Ruston, Zuber, Blichton, and Hernando) are extensive. On the wettest areas *Humic Gley soils* (Fellowship, Rutlege, and Pocomoke) are conspicuous but their total area is small. Of greater extent on broad flats and in depressions are *Low-Humic Gley soils* (Plummer, Rains, and Weston).

R—NORTHEASTERN FORAGE AND FOREST REGION

121,600 square miles

This cool, humid region consists of plateaus, plains, and mountains. The annual precipitation ranges from 30 to 50 inches; more than one-half occurs during the freeze-free season in most of the region. Average annual temperatures are 37° to 50° F. The freeze-free season is 120 to 160 days over most of the region but is less than 120 days in the higher mountains and as long as 180 days in a narrow belt along the Atlantic Coast.

Sols Bruns Acides and Podzols, both commonly having a fragipan, are the dominant soils of the region. Humic Gley soils, Low-Humic Gley soils, and Bog soils occupy the lowlands and depressions. Stoniness imposes serious restrictions on the use of many of the soils.

The production of forage for dairy cattle is the principal use of much of the farmland in the region. Where markets, climate, and soils are favorable, fruits, tobacco, potatoes, and various vegetable crops are important locally. The steeper land is mainly in forests, which produce significant amounts of timber; their use for recreation is probably more important in this highly urbanized region.

139—Eastern Ohio Till Plain

Ohio
6,500 square miles

Land Use: About three-fourths of the area is in farms, one-fifth is urban, and the remainder is in other uses. About one-third is cropland. Feed grains and forage for dairy cattle are the main crops in the west. Similar crops are grown in the east, where there are many part-time farms and many rural residences. Slightly more than 10 percent is in pasture. About one-fifth is in hardwood forest, mainly farm woodlots. Some large holdings are used for watershed protection.

Elevation and Topography: 800 to 1,000 feet, increasing gradually from north to south. The gently to strongly rolling dissected glaciated plateau is underlain by limestone and sandstone. Stream valleys are narrow and not deeply incised. In places the interfluves are broad and nearly level. Local relief is in a few feet to a few tens of feet.

Climate: *Average annual precipitation*—35 to 40 inches; fairly evenly distributed through the year although slightly higher in spring and early summer and lowest in winter; winter precipitation is mostly snow. *Average annual temperature*—About 50° F. *Average freeze-free period*—About 160 days.

Water: Rainfall, perennial streams, and ground water provide an abundance of water. Shallow and deep wells are the main sources of water for domestic use and municipal supplies. On many farms small artificial ponds provide water for livestock and supplemental irrigation and are used for recreation. Large reservoirs on perennial streams provide water for several of the large cities.

Soil: *Gray-Brown Podzolic soils,* many having a fragipan, are dominant (Wooster, Canfield, Mahoning, Ellsworth, and Rittman from medium- to fine-textured glacial till; imperfectly drained Ravenna and Wadsworth; and Chili from coarse-textured glacial outwash). Other soils are *Low-Humic Gley soils* (Trumbull) and where parent materials are less clayey and more acid, *Sols Bruns Acides* (Venango).

140—Glaciated Allegheny Plateau and Catskill Mountains

New York and Pennsylvania
27,400 square miles

Land Use: Most of the area is in farms but a large acreage is in cutover forests of mixed hardwoods. The Catskills are used mainly for recreation. Hay, pasture, and some grain for dairy cattle are the principal crops. Potatoes are important locally on the plateau top, and poultry, fruits, and truck crops are produced in many of the narrow valleys. Abandoned or idle areas are in poverty grass, weeds, and shrubs.

Elevation and Topography: Valley floors 500 to 1,000 feet, plateau tops 1,700 to 2,000 feet, and parts of the Catskills 3,500 feet or more. The tops of the dissected plateau are broad and nearly level to moderately sloping. The narrow valleys have steep walls and smooth floors. The Catskills in the east have steep slopes.

Climate: *Average annual precipitation*—30 to 40 inches; half or more falls during the growing season; winter precipitation is mostly snow. *Average annual temperature*—47° to 50° F. *Average freeze-free period*—110 to 160 day.

Water: Rainfall and perennial streams and lakes provide an abundance of water. The Finger Lakes are a conspicuous feature along the northern border. Soils with fragipans have extremes of moisture. They are too wet in winter and spring and deficient in moisture during much of the growing season.

Soil: Most of the soils are *Sols Bruns Acides*—moderately deep to deep, somewhat stony, medium-textured, moderately to somewhat poorly drained, acid soils with fragipans (Mardin, Volusia, and Morris) on the nearly level to moderately sloping till-mantled uplands; shallower and more stony soils (Lordstown and Oquaga) on the steeper slopes; and deep loamy

well-drained soils (Chenango) from outwash in valleys. *Alluvial soils* (Tioga, Chagrin, Genesee, and Barbour) are in the younger stream deposits on valley floors. *Podzols* at higher elevations (Catskill) and *Gray-Brown Podzolic soils* from limy outwash materials (Howard and Palmyra) are conspicuous locally but of small total extent.

141—Tughill Plateau

New York
1,500 square miles

Land Use: Nearly 90 percent of the area is in farms or other private holdings; the remainder is Federally owned or urban or in other uses. More than one-half of the area is in forest, mainly of northern hardwoods; spruce and balsam grow at higher elevations and on some wet sites. Part of the forested land is abandoned farmland that has been reforested and additional land is now being reforested. Lumber, pulpwood, and maple sirup are the principal forest products. Less than one-tenth of the area is cropland. Forage and some feed grains for dairy cattle are the major crops. Slightly less than one-tenth of the area is in pasture.

Elevation and Topography: 1,000 feet along the lower margins to 2,000 feet at the plateau top. This level to gently sloping sandstone plateau has hilly to steep margins. Local relief is mainly in a few feet to a few tens of feet, but the bordering lowlands are several hundred feet below the plateau top.

Climate: *Average annual precipitation*—35 to 40 inches; evenly distributed; precipitation from late autumn to early spring is mainly snow and as much as 140 inches falls in some places. *Average annual temperature*—40° to 45° F. *Average freeze-free period*—120 to 140 days.

Water: Ground water, perennial streams, and rainfall provide an abundance of water. Shallow and deep wells provide water for domestic and livestock use. The water resources available in perennial streams are little used at present.

Soil: *Podzols* from acid glacial till (Worth, Empeyville, Pinckney, Camroden, and Westbury) are the dominant soils. Most of them have a slowly permeable lower subsoil (fragipan), and all are stony to some extent. *Low-Humic Gley soils* (Dannemora) are extensive on poorly drained flats and in depressions and *Bog soils* are in the wettest depressions.

142—St. Lawrence-Champlain Plain

New York and Vermont
7,000 square miles

Land Use: Nearly all the area is in farms, but about 5 percent is urban or in other uses. About 70 percent is evenly divided between cropland and pasture. Hay meadows occupy by far the largest acreage, but some oats are grown as well as corn for silage. Grain, hay, and silage are fed to dairy cattle. Potatoes are an important cash crop and a few large apple orchards are on the slopes along Lake Champlain, but the total acreage in these crops is small. Most pastures are mixtures of tame and native grasses and shrubs and have a low carrying capacity. About one-fourth of the area is in forest. Native hardwoods grow on the better drained sites and conifers on most of the wet sites. Gray birch is the dominant tree on cutover land and on abandoned farmland with very sandy soils. Lumber is the main forest product, and cedar oil, Christmas trees, and maple sirup are produced on some farms.

Elevation and Topography: 100 feet to 1,300 feet, increasing gradually from the St. Lawrence River southward and from Lake Champlain to both the east and west. A few large rivers have cut deep but very narrow valleys across this smooth lacustrine and glacial plain. Local relief is mainly in only a few feet, but some outwash terraces rise sharply several tens of feet above the adjacent plains.

Climate: *Average annual precipitation*—About 35 inches; evenly distributed through the year; snowfall is heavy from late autumn to early spring. *Average annual temperature*—40° to 45° F. *Average freeze-free period*—120 to 140 days but 160 days in a narrow belt along Lake Champlain.

Water: Rainfall, many perennial streams, and ground water provide an abundance of water over most of the area. Although shallow wells are undependable, deep wells in glacial drift yield large amounts of water. The ground water in areas underlain by limestone is highly mineralized. The St. Lawrence Seaway, which is the northern border in New York, and Lake Champlain in the east are important transportation arteries and are used extensively for recreation.

Soil: *Low-Humic Gley soils* (Panton, Swanton, and Coveytown) and *Humic Gley soils* (Livingston and Cook) in fine- to coarse-textured lacustrine and marine sediments are dominant at the lowest elevations. Associated with them on narrow low ridges of highly calcareous glacial till are *Brown Forest soils* (Grenville and Nellis) and *Podzols* (Empeyville, Worth, Moira, Westbury, and Adams) on the higher till plains and outwash plains underlain by acid drift derived largely from sandstone. The extensive rock outcrops on low hills are a prominent feature in the west.

143—Northeastern Mountains

New York, Maine, New Hampshire, Vermont, and Massachusetts
36,900 square miles

Land Use: More than 90 percent of the area is in forest of northern hardwoods, spruce, and fir. Most of the Adirondacks are in a State park. A few fairly large areas in New England are in National and State forests, but much of the area is privately owned. Lumbering is important except in the Adirondacks. Christmas trees and maple sirup are other forest products. The area is widely used for recreation and there are many summer and winter resorts. Less than 5 percent of the area is cropland or in pasture. Farming is a part-time enterprise and most farm operators earn a major part of their living at other occupations.

Elevation and Topography: 1,000 to 4,000 feet, a few isolated peaks more than 5,000 feet. Rounded

mountains are underlain by granite, anorthosite, schists, and slate and are thinly mantled by glacial till. Many glacially broadened valleys are deeply filled with outwash and contain many swamps and lakes. Mountain slopes are strongly rolling to steep but valley floors are level. Local relief ranges from 100 to 200 feet on the lower foot slopes to more than 1,000 feet in the central mountain masses.

Climate: *Average annual precipitation*—35 to 50 inches, highest in the Adirondacks; evenly distributed through the year although slightly lower in midwinter; heavy snowfalls are common in winter. *Average annual temperature*—Less than 40° F. in northern Maine, 40° to 45° F. elsewhere. *Average freeze-free period*—Mostly less than 120 days but as long as 140 days in the foothills.

Water: Rainfall, perennial streams, and lakes provide an abundance of water. Ground water is abundant in deep outwash in valleys but is scarce in the till-mantled uplands. The many lakes provide extensive recreational facilities.

Soil: *Podzols* are the dominant soils (Hermon, Becket, and Canaan in glacial till from granite rocks; Plaisted, Thorndike, Lyman, Berkshire, and Marlow in till from slates and schists; and Adams, Au Gres, Allagash, Colton, and Duane from acid sandy and gravelly outwash). Many of the soils from glacial till are stony, and rough stony land or rockland on the steepest mountain slopes occupy 5 to 10 percent of the area. Peat is extensive in the wet lowlands as are *Humic Gley soils* (Whitman and Scarboro) in many places.

144—New England and Eastern New York Upland

Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, and New Jersey
38,100 square miles

Land Use: About two-thirds of the area is in forest, mainly of hardwoods and white pine and, in the north, some fir and spruce. Most of the forest is in small holdings in farm woodlots, but some is in State forests or other large holdings. Lumber is the principal product and maple sirup and Christmas trees are produced on some farms. The woodland of this area is used widely for hunting and other recreation. About one-fifth of the area is in crops and pastures; the amount of land in crops is somewhat greater than that in pasture. Most of the cropland is in forage crops for dairy cattle. Potatoes, other vegetables, and apples are grown on some farms, mainly near the larger towns and cities. Much of the farming is on a part-time basis. Many farmsteads are used as rural residences and the occupants earn their living from nonfarm occupations. About one-tenth of the area is urban and the amount is increasing rapidly, especially in the south.

Elevation and Topography: Sea level to 1,000 feet over much of the area, some hills 2,000 feet, and a few isolated peaks 3,000 feet. The till-mantled rolling to hilly uplands are broken by many level to gently sloping valleys that terminate in coastal lowlands. These valleys and coastal plains are covered by glacio-lacustrine and marine sediments and outwash. Relief is mostly in a few feet to a few tens of feet in the valleys and in several tens of feet to a few hundred feet in the uplands.

Climate: *Average annual precipitation*—40 to 45 inches, decreasing to 35 inches in the northwest; evenly distributed through the year except slightly lower in spring and summer near the coast and slightly higher in spring and summer inland. *Average annual temperature*—40° to 50° F., increasing from north to south. *Average freeze-free period*—120 to 160 days, increasing from north to south; 180 days or more in a narrow belt along the coast in Massachusetts and southward.

Water: The abundant rainfall, many perennial streams, and many natural lakes and ponds are the important water sources. Many large and small reservoirs provide municipal and industrial water supplies. Ground water is scarce in the till-mantled uplands but is abundant in the deep outwash deposits in the valleys.

Soil: This area has a complex soil pattern. *Podzols* (Hermon, Becket, Bangor, Colton, and Adams) are dominant on the higher hills that have a thin till mantle and the associated areas of sandy glacial outwash in northern New England. On lower areas in northern New England and in much of southern New England, where the parent materials are deeper drift and lacustrine sediments, *Brown Podzolic soils* (Charlton, Gloucester, Paxton, Hollis, Merrimac, Hinckley, Suffield, Buxton, and Agawam) are dominant. In the uplands bordering the Hudson Valley of New York, *Sols Bruns Acides* (Nassau, Troy, Cossayuna, Stockbridge, Rockaway, and Chatfield) are most extensive. *Brown Forest soils* (Nellis, Dover, Benson, and Amenia) in highly calcareous shallow till underlain by limestone are conspicuous locally but are of small total extent. *Alluvial soils* (Ondawa, Podunk, Hadley, and Winooski) on narrow flood plains are highly important to agriculture even though their total acreage is small.

145—Connecticut Valley

Connecticut and Massachusetts
1,700 square miles

Land Use: About four-fifths of the area is in farms; most of the remainder is urban or in built-up areas. About one-fourth of the land is cleared and used for crops but some is in pasture. Tobacco, vegetables, potatoes, fruits, and nursery stock are major crops. Forage crops for dairy cattle occupy a substantial acreage on many farms. Poultry farming is also important in some places. About one-half of the area is in forest of hardwoods and white pine, mainly in farm woodlots. Firewood and fence posts are the principal forest products, and some lumber is produced. Maple sirup and Christmas trees are important forest products on a few farms.

Elevation and Topography: Sea level to 300 feet in lowlands, ridge crests 500 to 1,000 feet. Nearly level to sloping lowlands mantled by glacio-lacustrine and

marine sediments, glacial till, and outwash are broken by isolated north-south-trending traprock ridges that have hilly and steep slopes. Lowlands have local relief of a few feet to a few tens of feet; the ridges are several hundred feet above the lowlands.

Climate: *Average annual precipitation*—About 45 inches; fairly evenly distributed through the year except slightly higher in spring and summer. *Average annual temperature*—45° to 50° F. *Average freeze-free period*—160 to 180 days.

Water: Rainfall, perennial streams, and ground water provide an abundance of water. Water for municipal and industrial needs is stored in reservoirs in this area and in adjoining areas.

Soil: *Brown Podzolic soils* (Buxton, Hartland, and Whippany in glacio-lacustrine or marine sediments; Agawam, Merrimac, Enfield, and Hinckley from outwash; Cheshire and Wethersfield from red glacial till; and Holyoke from traprock) are dominant. *Alluvial soils* (Hadley, Winooski, and Ondawa) on narrow flood plains and *Low-Humic Gley soils* (Scantic) in glacio-lacustrine or marine sediments are the other principal soils and are widely used for agriculture.

146—Aroostook Area

Maine
2,500 square miles

Land Use: Nearly all the land is in farms and between one-half and three-fourths is cleared and in crops. Potatoes are the major crop, but some land is in oats and hay meadow in support of dairying. Most of the remaining part is in farm woodlots. Firewood and fence posts are the principal forest products; some lumber, maple sirup, and Christmas trees are produced.

Elevation and Topography: 300 to 500 feet, a few hills 1,000 feet. This is a nearly level to rolling glaciated plain cut by narrow valleys. Thin to thick till mantles the uplands, and the valleys are deeply filled with outwash and alluvium. Local relief is in a few feet to a few tens of feet.

Climate: *Average annual precipitation*—36 to 40 inches; fairly evenly distributed through the year; snowfall is heavy in winter. *Average annual temperature*—37° to 41° F. *Average freeze-free period*—110 to 125 days.

Water: Rainfall and the many perennial streams provide an abundance of water. Ground water is plentiful in the outwash and alluvium in the valleys but is scarce in the till and bedrock in the uplands.

Soil: *Podzols* are dominant throughout the area (Thorndike and Mapleton, shallow soils over acid and calcareous bedrock; Caribou from glacial till over limestone; Plaisted and Howland from mixed or acid rocks; and Allagash and Stetson from outwash). *Low-Humic Gley soils* (Monarda and Easton) are the major soils on the associated wet areas. *Alluvial soils* (Hadley and Winooski) on flood plains are highly important to agriculture but their total area is small.

S—NORTHERN ATLANTIC SLOPE TRUCK, FRUIT, AND POULTRY REGION

44,100 square miles

This region consists of three resource areas—gently to steeply sloping Northern Coastal Plain, Northern Piedmont, and Northern Appalachian Ridges and Valleys. The average annual precipitation is 40 to 50 inches over most of the region but only 32 to 36 inches in the ridges and valleys in western Maryland and West Virginia. Precipitation is slightly higher in midsummer than during the remainder of the year. Average annual temperatures are 50° to 57° F. The freeze-free season ranges from 140 days in the mountains to 210 days along the shore of the Chesapeake Bay but is 180 to 200 days in much of the region.

Soils on the steep slopes are mainly Sols Bruns Acides. On the gentle slopes Red-Yellow Podzolic soils are dominant but some soils, mainly on limestone materials, are in the Gray-Brown Podzolic group.

Poultry and dairy farming are the leading agricultural enterprises in the region; fruit and truck crops are also important in many places. Many farms are operated on a part-time basis by people who earn most of their living in the cities, and rural residences occupy some areas where the land is less favorable for farming. The encroachment of urban areas on farmland is a problem throughout the region. Steep slopes are largely in forests, which are used for both timber production and recreation.

147—Northern Appalachian Ridges and Valleys

Pennsylvania, Maryland, West Virginia, and Virginia
15,700 square miles

Land Use: Most of the area is in farms, about 5 percent is urban, and an additional 10 percent is in other uses. Between one-fourth and one-third is cropland. The wide variety of agricultural enterprises and crops is characteristic of the area. On many farms forage and feed grains for dairy cattle are the principal crops; tobacco, apple orchards, and truck and canning crops are also important throughout the area. Poultry farming is important, especially in the north. Less than 10 percent of the area is in permanent pasture. About one-half is in hardwood forest, mainly in small to medium-sized holdings and some in State and National forests and parks.

Elevation and Topography: 400 to 1,000 feet in valleys and 1,200 to 2,500 feet on ridges and mountains, some mountain crests 3,000 feet. Parallel sandstone and shale ridges are separated by narrow to moderately broad limestone and shale valleys. Ridges have hilly to steep slopes and narrow rolling crests; valleys are mainly undulating to rolling but are hilly locally. Local relief in the valleys is in several tens of feet to 100 or 200 feet; ridges rise several hundred feet above adjoining valleys.

Climate: *Average annual precipitation*—32 to 45 inches; highest in spring and summer and least in autumn. *Average annual temperature*—50° to 55° F. *Average freeze-free period*—140 to 180 days.

Water: The favorably distributed abundant rainfall is adequate for crops in most years, but summer droughts reduce yields in some years. Springs and shallow wells are the principal sources of water for domestic and livestock use in the limestone valleys, but ground water is scarce in areas underlain by shale and sandstone. Recently small ponds have become an important source of water on many farms. Many small and large perennial streams are potential water sources that are not much used at present.

Soil: Soil patterns in this area are complex. *Red-Yellow Podzolic soils* (Duffield, Frederick, Frankstown, and Dunmore from limestone; Murrill and Laidig in colluvium; and Allenwood and Drifton from old glacial drift in the north) are dominant in most of the less sloping valleys. *Reddish-Brown Lateritic soils* having some features of *Gray-Brown Podzolic soils* and also formed in limestone materials (Hagerstown) are extensive soils important to agriculture. *Gray-Brown Podzolic soils* (Edom and Corydon from limestone residuum and Washington from old glacial drift) are important locally but of small total extent. On the slopes of ridges underlain by acid sandstone and shale *Sols Bruns Acides* (Dekalb, Calvin, Lehew, and Berks) are most extensive and *Lithosols* (Montevallo) are also important. *Alluvial soils* (Huntington, Lindside, Pope, and Philo) on flood plains are among the most important soils for crops but their total acreage is small.

148—Northern Piedmont

Pennsylvania, Maryland, Virginia, New Jersey, and Delaware
15,200 square miles

Land Use: More than four-fifths of the area is in farms, one-tenth is urban, and the remainder is in other uses. Slightly more than one-third of the entire area is cropland, but the proportion of cropland is somewhat higher in Pennsylvania and lower in Virginia. Forage crops and grain for dairy cattle occupy by far the largest acreage of cropland, but tobacco, canning and truck crops, and orchards are grown under high management levels on many of the better soils. Poultry farming is important in places. About one-eighth of the area is in pasture and one-third in forest, mainly in farm woodlots but some in large holdings.

Elevation and Topography: 300 to 1,000 feet, some ridges and isolated peaks 1,500 feet or more. This dissected plain or plateau underlain mainly by gneisses, schists, and related rocks is broken by narrow ridges that are underlain by traprock and by Triassic lowlands that are underlain by sandstones, shales, and limestones. Topography is mainly gently to strongly rolling and local relief is in a few tens of feet to 100 or 200 feet.

Climate: *Average annual precipitation*—40 to 45 inches; highest in spring and late summer and least in autumn. *Average annual temperature*—50° to 57° F. *Average freeze-free period*—160 to 200 days.

Water: The abundant rainfall and many perennial streams are important water sources. Shallow wells, cisterns, and a few springs are the major water sources on farms; recently small ponds have been built on many farms. Ground-water supplies are small in areas underlain by crystalline rocks but are somewhat larger in limestone and sandstone areas. Reservoirs on the larger streams are the principal sources of water for municipal and industrial uses in the large urban centers.

Soil: *Red-Yellow Podzolic soils* (Elioak, Nason, Tatum, and Eubanks) from schists and gneisses are dominant in the south; Duffield in limestone basins is extensive, mainly in Maryland and Pennsylvania. Associated with them are *Reddish-Brown Lateritic soils* having some properties of *Gray-Brown Podzolic soils* (Hagerstown). In the north soils having characteristics intermediate between *Red-Yellow Podzolic soils* and *Gray-Brown Podzolic soils* are most extensive (Chester, Glenelg, and Glenville from schists; Bucks, Penn, and Readington from Triassic sandstones and shales; Edgemont from quartzite; and Montalto from traprock). On hills and steep slopes *Sols Bruns Acides* (Manor, Brandywine, Louisburg, and Lewisberry) and *Lithosols* (Klinesville) are the major soils. Of small total extent but conspicuous locally are *Planosols* (Iredell and Croton) on wet flats or foot slopes and *Reddish-Brown Lateritic soils* (Davidson) on narrow traprock ridges in the south.

149—Northern Coastal Plain

New Jersey, Maryland, Virginia, New York, Massachusetts, and Delaware
13,200 square miles

Land Use: About three-fourths of the area is in farms, one-tenth is urban, and the remainder is in other uses. Recently the amount of urban land has increased rapidly. A narrow band along the coast in New Jersey and States to the north is intensively developed for resorts and recreation. Nearly three-fifths is in forest, mainly in farm woodlots but partly in large holdings. Lumber and some pulpwood are the principal forest products. About one-fifth is in crops, mainly cash crops, and less than 5 percent is in pasture. Fruits, vegetables, tobacco, corn, soybeans, and small grains are the major crops. Forage crops and grain for dairy cattle are important on some farms. Poultry farming is a major enterprise in some places.

Elevation and Topography: Sea level to 300 feet but less than 200 feet in most of the area. This undulating to rolling dissected coastal plain is underlain by unconsolidated sands, silts, and clays. Local relief is mostly in a few feet to a few tens of feet but is 100 feet or more in a few places.

Climate: *Average annual precipitation*—35 to 50 inches; highest near the coast and in midsummer and late summer. *Average annual temperature*—50° to 55° F. *Average freeze-free period*—170 to 210 days, decreasing from south to north and from the coast inland.

Water: Rainfall, perennial streams, and ground water provide an abundance of water. Domestic supplies are obtained mainly from shallow wells, but large supplies must be obtained from deep wells. In the coarse-textured well-drained soils, moisture is deficient in some years and supplemental irrigation from wells and ponds is used for high-value crops.

Soil: *Red-Yellow Podzolic soils* (Beltsville, Aura, Keyport, Sunnyside, Caroline, Christiana, and Kempsville) on the higher gently sloping to rolling uplands are the dominant soils over much of the area. Several of these soils have a strongly expressed fragipan. In lower areas soils having properties intermediate between those of *Gray-Brown Podzolic soils* and *Red-Yellow Podzolic soils* (Sassafras, Matapeake, Mattapex, and Woodstown) are most extensive. On associated wet lowlands are *Low-Humic Gley soils* (Othello, Elkton, and Fallsington). *Regosols* (Evesboro and Galestown) are in deep sands of undulating to rolling old dunes and beaches and *Sols Bruns Acides* (Croom) in gravel of rolling to hilly old beaches and terraces. *Gray-Brown Podzolic soils* having some properties of *Red-Yellow Podzolic soils* (Collington, Monmouth, and Adelphia) are the principal soils in glauconitic sands in Maryland and New Jersey. *Podzols* (Lakewood and Lakehurst) are in rapidly drained deep acid sands in New Jersey and *Ground-Water Podzols* (Leon and St. Johns) on associated wet lowlands. *Bog soils* occur on small to medium-sized flats in New Jersey, and tidal marsh of unclassified organic and mineral soils is in relatively narrow bands bordering all coasts.

T—ATLANTIC AND GULF COAST LOWLANDS FOREST AND TRUCK CROP REGION

77,200 square miles

This region consists of the nearly level low parts of the Atlantic and Gulf Coastal Plains.

The annual precipitation is 40 to 60 inches over most of the region but decreases sharply to about 25 inches in the extreme western part. The Mississippi River Delta, however, receives as much as 65 inches. Average annual temperatures are 65° to 70° over much of the region but decrease to 55° F. in the north. The freeze-free season ranges from 200 days in the north to 320 days in the south.

Low-Humic Gley soils, Ground-Water Podzols, and Bog soils are dominant along the Atlantic and Gulf coasts east of the Mississippi River Delta. West of the delta, Grumusols and Planosols are the principal soil groups.

Most of the soils are too wet to be used for crops without artificial drainage. Drained areas are used mainly for truck crops and cotton and to some extent for improved pastures. Sugarcane and rice are important crops in Louisiana and east Texas. Undrained areas to the east of the Mississippi River Delta remain in forest.

150—Gulf Coast Prairies

Texas and Louisiana
15,900 square miles

Land Use: Nearly all the area is in farms. Rice, cotton, corn, grain sorghum, and alfalfa and other hay are the major crops; a large acreage is in pasture or range of native grasses, tame grasses, and legumes. Bottom-land hardwood forests border several streams that cross the area.

Elevation and Topography: Sea level to about 200 feet along the interior margin. The level low coastal plain has local relief of only a few feet.

Climate: *Average annual precipitation*—25 to 55 inches, increasing from west to east; evenly distributed except somewhat higher in midsummer and late summer. *Average annual temperature*—68° to 70° F. *Average freeze-free period*—280 to 320 days.

Water: The moderate to high rainfall and many perennial streams provide abundant water. Water for irrigating rice is obtained from streams. Ground water is abundant. Much of the land must be drained before it can be successfully used for the general farm crops.

Soil: Dark-colored *Grumusols* (Beaumont, Lake Charles, and Victoria); *Planosols* (Edna, Crowley, Katy, and Orelia); and *Low-Humic Gley soils* (Midland) all from calcareous clays and marls are the dominant soils. Some *Reddish Prairie soils* (Bernard and Hockley) are on the somewhat better drained sites. *Alluvial soils* (Miller, Yahola, Trinity, and Navasota) occur in broad bands bordering a few of the larger streams. *Regosols* (Galveston) are on dunes and beaches and there are narrow strips of marshland along the coast.

151—Gulf Coast Marsh

Texas and Louisiana
8,000 square miles

Land Use: Only a small part of the area is in farms and little or none is cropped. The drier parts are grazed seasonally, but hunting, fishing, and trapping are the principal uses. Oil wells and sulfur wells are important in some places. Reeds, cattails, bulrush, fresh-water marsh grasses, and salt grasses occupy most of the area. Mangrove is prominent in places near the coast, and forests of cypress, tupelo gum, and other wetland hardwoods border the area on the landward side.

Elevation and Topography: Sea level to less than 5 feet above sea level. Marshes and swamps are broken by shallow lakes and bayous and are crossed by many stream channels. Except for narrow bands of gentle slopes on natural levees, the area is flat.

Climate: *Average annual precipitation*—55 to 65 inches; highest in midsummer and early autumn and lowest in midautumn. *Average annual temperature*—About 70° F. *Average freeze-free period*—280 days to more than 300 days.

Water: Much of the area is periodically covered either by tide flow or by stream overflow. Flooding and salinity preclude use of most of the area for agriculture.

Soil: Peat deposits mainly from herbaceous plants cover most of the area to a depth of several feet except in the west where clays are predominant. In the swamps along the northern fringe, the peat is largely from woody materials and contains less salt than the peats near the coast. Along stream channels and natural levees, there are narrow bands of recently deposited silts and clays at the surface.

152—Gulf Coast Flatwoods

Florida, Alabama, and Mississippi
10,500 square miles

Land Use: Very little of this area is in farms. Much of it is in large holdings owned by pulp and paper companies; part is in State and National forests, game refuges, and military training areas. Nearly nine-tenths of the area is forested; lumber, pulpwood, and naval stores are the principal forest products. Part of

the woodland is grazed seasonally. Only 1 or 2 percent of the area is cropped and a like amount is in pasture. Fruits, vegetables, and livestock are produced, mainly for home consumption. Some corn, peanuts, and tobacco are grown for sale.

Elevation and Topography: Sea level to 50 feet and locally to 100 feet. This nearly level low coastal plain is crossed by many large streams. The areas in Florida have many lakes and ponds. Local relief is a few feet to 10 or 20 feet.

Climate: *Average annual precipitation*—52 to 64 inches; lowest in midautumn, increasing moderately in winter through early summer, and highest in midsummer and early autumn. *Average annual temperature*—67° to 70° F *Average freeze-free period*—270 to 310 days

Water: The abundant rainfall and many perennial streams are important water sources. Ground water is plentiful but is affected by salt in many places near the coast.

Soil: A very large part of the area has soils with restricted drainage. *Humic Gley soils* (Portsmouth, Bayboro, and Pocomoke) and *Ground-Water Podzols* (Leon, Immokalee, and St. Johns) associated in a complex pattern in sandy and clayey sediments and *Low-Humic Gley soils* (Plummer, Bladen, Rains, and Parkwood) are the major soils. *Regosols* (Lakeland, Blanton, and Orlando) on old sand dunes and beach ridges are the other principal soils. Some *Red-Yellow Podzolic soils* (Goldsboro and Lynchburg) are on the better drained uplands. There are narrow bands of beaches and dunes along the coast. Small to fairly large areas of tidal marsh, fresh-water marshes, and swamps border the dunes on the landward side.

153—Atlantic Coast Flatwoods

Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, and Florida
42,800 square miles

Land Use: Most of the area is in farms but some is in national forests, game refuges, and related uses. More than two-thirds is in forest, partly in farm woodlots but much in large holdings. Pulpwood is the main wood product; lumber and naval stores are other sources of income from forests. About one-eighth of the area is cropland and only 1 or 2 percent is in pasture. The proportion of cropland is somewhat higher in the north and nearly two-fifths of the Delmarva Peninsula is cropland. Vegetable crops, fruits, melons, sweetpotatoes, and Irish potatoes are highly important; corn, soybeans, wheat, and barley occupy large acreages, especially in the north. Some peanuts are grown on the better drained soils in Virginia and Georgia. Poultry farming is important in the north. Only a few other livestock are raised although recently the number of beef and dairy cattle has increased.

Elevation and Topography: Sea level to 100 feet; several low escarpments break the gradual increase from the coast inland. The nearly level coastal plain is crossed by many broad shallow valleys with widely meandering stream channels. Most of these valleys terminate in estuaries along the coast. Local relief is mainly a few feet to 10 or 20 feet. Some short steep slopes border the stream valleys.

Climate: *Average annual precipitation*—40 to 50 inches; highest in summer and lowest in autumn. *Average annual temperature*—55° to 70° F. *Average freeze-free period*—200 to 260 days, 280 days in a narrow belt along the coast, and 300 days in the extreme south.

Water: Rainfall, perennial streams, and ground water provide an abundance of water. Water for domestic, municipal, and industrial use is obtained mainly from wells. Although many soils require artificial drainage before they can be used for crops, crops grown on some of the sandy soils need irrigation during droughts.

Soil: Soils having restricted drainage are dominant throughout the area. Most extensive are *Low-Humic Gley soils* (Plummer, Fallsington, and Rains in sandy sediments and Othello, Weston, Bertie, and Edisto in materials of finer texture). The associated wetter areas have *Humic Gley soils* (Pocomoke, Portsmouth, and Bayboro). *Red-Yellow Podzolic soils* (Lynchburg, Goldsboro, Keyport, Craven, and Eulonia) are on higher areas having somewhat better but still restricted drainage. On better drained sites in the north *Gray-Brown Podzolic soils* that have some properties of *Red-Yellow Podzolic soils* (Matapeake and Mattapex in silts and Sassafras and Woodstown in sands) are the major soils. Other locally important soils are *Ground-Water Podzols* (Leon and St. Johns) in wet sands and *Regosols* (Lakeland, Evesboro, Blanton, and Eustis) on old beach ridges and dunes. Large areas of tidal marsh of unclassified organic and mineral soils are along the coast and extend up the estuaries of most of the large streams. *Bog soils* also occupy fairly large areas, especially in the Dismal Swamp of Virginia and the Okefenokee Swamp of Georgia and Florida.

U—FLORIDA SUBTROPICAL FRUIT, TRUCK CROP, AND RANGE REGION

33,600 squares miles

This region consists of the southern two-thirds of the Florida peninsula. The average annual precipitation is 50 to 64 inches. Average annual temperatures are 70° to 75° F., and the freeze-free season ranges from 300 days in the north to 365 days in the south. A large part of the region lies south of the southern limit of annual frost.

Ground-Water Podzols, Low-Humic Gley soils, and Bog soils are the dominant soils on flat lands, but Red-Yellow Podzolic soils and sandy Regosols are dominant on the higher, more sloping ridges. There are large areas of Lithosols underlain by coral limestones in the south.

Citrus fruits, other subtropical fruits, and winter vegetables are the major crops throughout the region, but the acreage in pasture is somewhat larger than that in crops. More than two-thirds of the region is in forest or other native vegetation, much of which is grazed. Beef cattle are the principal livestock, and dairying is important near the larger cities. Sugarcane is a major crop locally in the south, and recently its acreage has been increasing rapidly.

154—South-Central Florida Ridge

Florida
8,500 square miles

Land Use: About four-fifths of the area is privately owned, but only a small part is organized into farms. About two-fifths is in forest, partly in national forests and game refuges but mostly in other large holdings. Pulpwood and naval stores are the chief forest products. The forests are grazed extensively. About one-tenth of the area is in crops. This is the major citrus-producing area of Florida. Other subtropical fruits and many kinds of winter vegetables are grown also. More than one-fourth of the area is in pasture. About one-fifth of the pasture is improved and is intensively managed; the trend is to more pastures of this kind. Beef cattle are the principal livestock and dairying is important near some of the large cities. Phosphate mines are a prominent feature in the northern part of the area and in a few places they are encroaching on farmland.

Elevation and Topography: 50 to 150 feet, some hills 250 feet, and a narrow strip along the western edge at sea level. The nearly level to gently rolling coastal plain has a sandy mantle of varying thickness over limestone. The land surface is very irregular because of the many sinkholes that dot the area. Local relief is mainly in a few feet to a few tens of feet but in places is 100 feet or more.

Climate: *Average annual precipitation*—50 to 57 inches; highest in summer and early autumn and lowest in late autumn and winter. *Average annual temperature*—70° to 74° F. *Average freeze-free period*—300 to 350 days.

Water: Rainfall and ground water supply an abundance of water. Wells in the cavernous limestone that underlies much of the area yield large amounts of water that is highly mineralized but of good quality otherwise. There are many lakes in the sinkholes throughout the area but few perennial streams.

Soil: *Regosols* (Lakeland and Blanton formed in acid sands and Arredondo, Fort Meade, and Gainesville formed in phosphatic sands) are the dominant soils of the area. *Red-Yellow Podzolic soils* (Blichton and Zuber) formed in moderately fine and fine textured phosphatic parent materials are also important.

155—Southern Florida Flatwoods

Florida
17,900 square miles

Land Use: About nine-tenths of the area is privately owned. Most of the remainder is in State and National forests, parks, game refuges, and military facilities. Most of the privately owned land is in large holdings and only a small part is organized into operating farm units. Slightly more than one-fourth of the total area is in forest, mostly of longleaf and slash pine and also some hardwoods. The forests are grazed extensively. About one-half of the area is in pasture. One-fourth to one-fifth of the pastures have adequate water-control systems and have a high carrying capacity. The remaining rangeland, consisting of mixed tame and native vegetation, has a low carrying capacity. Recently, the trend is to more improved pastures. About 5 percent is cropped, principally to many kinds of winter vegetables. Citrus fruits and some other subtropical fruits are increasing in importance.

Elevation and Topography: Sea level to 100 feet, increasing gradually from the coast inland. The nearly level coastal plain is mantled by sand of varying thickness over limestone. The many swamps, marshes, lakes, and streams are prominent landscape features. Most of the area is flat but some hammocks rise a few feet above the general level.

Climate: *Average annual precipitation*—50 to 60 inches; highest in summer through early autumn and much lower in late autumn and winter. *Average annual temperature*—70° to 75° F. *Average freeze-free period*—300 to 365 days.

Water: Rainfall, surface water, and ground water provide an abundance of water. On much of the cropland ground-water levels are controlled by canals and ditches. Excess water is pumped out during the rainy season and irrigation is provided during the growing season. Domestic and municipal water supplies are obtained mainly from wells in the underlying limestone. Water from this source is highly mineralized.

Soil: *Ground-Water Podzols* (Leon, Immokalee, and Pomello) from deep sands are the dominant soils. On wetter flats and depressions *Humic Gley soils* (Rutlege, Delray, and Manatee) and *Low-Humic Gley soils* (Pompano and Plummer) are the major soils. Locally, narrow to broad bands of tidal marsh occur along the coast. Inland, fresh-water marshes and swamps are common. *Regosols* (Blanton, Lakeland, and Adamsville) are conspicuous on low old beach ridges and dunes. They are of small total extent but are important to agriculture.

156—Florida Everglades and Associated Areas

Florida
7,200 square miles

Land Use: Slightly more than one-half of the area is in Indian reservations, national parks, game refuges, and other large holdings. About one-fifth is forested. Cypress forests are most extensive but mangrove is widespread along the eastern and southern coasts. A large part of the area is open marsh covered by water-loving grasses, reeds, sedges, and other aquatic herbaceous plants. Hunting, fishing, and other recreational activities are major uses of much of the area. Only 5 percent is cropland and about 15 percent is in pasture. Winter vegetables constitute the main crop but some citrus fruits, avocado, and papaya are grown on better drained sites. Recently sugarcane has become increasingly important on the Bog soils south of Lake Okeechobee. The acreage of improved pasture has been increasing. Beef cattle are the principal livestock and dairying is important locally.

Elevation and Topography: Sea level to 25 feet. The level low coastal plain contains large areas of swamps and marshes. Poorly defined broad streams, canals, and ditches drain the area to the ocean. Most of the area is flat, but in the interior hammocks rise a few feet above the general level. Low beach ridges and dunes, mainly in the east, rise several feet above the adjoining swamps and marshes.

Climate: *Average annual precipitation*—50 to 64 inches; highest from late spring through midautumn and much lower in late autumn and winter. *Average annual temperature*—72° to 75° F. *Average freeze-free period*—335 to 365 days.

Water: Rainfall, surface water, and ground water provide an abundance of water. Near the coast both surface water and ground water may contain salts. A large part of the area is flooded during the rainy season. Canals and ditches are used to control the ground-water level for crops and pasture. Excess water is removed by pumping during the rainy season and irrigation water is applied during the dry season. Domestic and municipal water supplies are obtained from wells in the underlying limestones. The water is highly mineralized.

Soil: *Bog soils* (Loxahatchee, Everglades, and Gandy and large areas of unclassified muck and peat in swamps and marshes) are the principal soils in the area. In areas slightly less wet *Humic Gley soils* (Ochopee) and *Low-Humic Gley soils* (Perrine, Charlotte, Keri, Pompano, and Arzell) are also extensive. *Ground-Water Podzols* (Immokalee) on sandy flats and *Regosols* (Palm Beach, Lakewood, and St. Lucie) on old beaches and dunes are conspicuous in places but of small extent. *Lithosols* (Rockdale) and rockland occupy large areas in the southeastern part of the Everglades.

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APPENDIX

Descriptions of Great Soil Groups

The descriptions that follow summarize the main characteristics of the principal great soil groups in the United States.[1] Each group consists of a great many soils that have the main internal features in common but still have a considerable range in characteristics. The descriptions apply to the upper 3 to 6 feet of soil.

Alluvial soils: These soils formed in geologically recent alluvium. In some places they are stratified, but they have no layers produced by soil-forming processes except a surface layer that may have gained some organic matter. They range in surface texture from sand to clay and in permeability from rapid to slow. Alluvial soils occur on bottom lands, where they are commonly susceptible to flooding, and also on low terraces and alluvial fans, where flooding seldom occurs. They are used intensively for agriculture.

Alpine Meadow soils: These usually rather wet dark-colored soils occur at high elevations. Their organic-matter content is high but they are not peaty. Surface textures are coarse to medium and the soils commonly contain some rock fragments. They are frozen more than half the time and cool and moist the rest of the time. Permeability is moderate to slow. Alpine Meadow soils formed under open woods or meadows above the timberline on the slopes and crests of mountains in the West. They are used mainly for summer grazing.

Ando soils: These dark-colored acid soils formed in volcanic ash. They have low bulk density but a very high water-holding capacity; they are high in organic matter and allophane clay. Surface textures are mainly loams, but there are some silt loams. Permeability is moderate to slow. In the United States these soils occur mainly in the Pacific Coast States. Most of them are on forested mountains, but some are on plains and are used for farming.

Bog soils: These waterlogged soils consist of peat or muck, that is, the remains of plants. They commonly occur in closed basins, many of which are small. Bog soils formed under both forest and herbaceous vegetation in cool to warm humid regions. They are extensive in the Central States and on the lower Atlantic and Gulf Coastal Plains; some occur in widely separated areas throughout the West. Drainage and fertilization are required for most crops.

Brown Forest soils: These soils have a very dark brown surface layer rich in humus that grades through a lighter colored subsoil to the calcareous parent material. They are slightly acid to slightly alkaline in contrast to Sols Bruns Acides, which are strongly acid. Surface textures are sandy loams and loams. Permeability is moderate. Brown Forest soils formed under hardwood forest in cool humid climates. They occur mainly in the Northeastern States. They are used for hay, pasture, and forestry.

Brown Podzolic soils: These soils are closely related to Podzols, but they do not have a light-colored leached surface layer. They have a brown surface layer over a darker subsoil in which humus and oxides of iron and aluminum have accumulated. In some places the subsoil grades to lighter colored parent material, but more commonly it overlies a firm to compact brittle layer (fragipan), which in turn grades to parent material. The surface and subsoil layers are strongly acid. The parent material is acid, at least in the upper part. Surface textures are sandy loams and loams. Permeability is moderate in soils that have no fragipan but is slow in soils that have a fragipan. Brown Podzolic soils formed under hardwood or mixed forests in cool to temperate humid climates. They occur mainly in the Northeastern States. Much of the area in these soils remains in forest, but some areas are used for hay and pasture.

Brown soils: These soils have a brown surface layer of moderate thickness that grades to lighter colored soil of similar texture. They have an accumulation of calcium carbonate at some depth between 1 and 3 feet. Surface textures range from sandy loams to silty clay loams. Permeability is moderate to slow. Brown soils formed under short grasses and shrubs in semiarid temperate to cool regions. They are mainly in the western Great Plains, but there are also significant areas in parts of the plains and plateaus throughout the West. They are used for wheat production and for range.

Brunizems (Prairie soils): These soils have a very dark brown to black acid thick surface layer that is rich in organic matter. In some places the brown subsoil is mottled. The lighter colored parent material is at a depth of 2 to 5 feet. Textures are mainly loams, silt loams, and silty clay loams. Permeability ranges from slow to moderate. Brunizems formed under tall grasses in a humid temperate climate. They occur mainly in the Central States and in the plains and plateaus of the Northwest. They are used mainly for the production of corn, other feed grains, hay, and wheat.

[1] Concepts of great soil groups are those given in the 1938 Yearbook of Agriculture, pp. 996–1001, as modified in Soil Sci. 67: 117–126, 1949.

Calcisols: These soils commonly have a light-colored surface layer but have a dark-colored surface layer in more humid areas. They contain some calcium carbonate throughout and have a layer that is especially high in calcium-carbonate accumulation. Textures are mostly loams and silt loams, but there are also some silty clay loams. Permeability ranges from moderate to slow. Calcisols formed under grasses or shrubs in cool to warm, subhumid to semiarid regions. They are widespread throughout the Great Plains and in the plains, plateaus, basins, and valleys of the West. They are used mainly for range, but some areas are dryfarmed and some areas are irrigated for crops.

Chernozems: These soils have a thick black surface layer that is rich in organic matter, a brown transitional subsoil layer, light-colored parent material, and a layer of calcium-carbonate accumulation at a depth of 1½ to 4 feet. In some places the subsoil is higher in clay than the overlying and underlying layers. Textures are mainly loams, silt loams, and silty clay loams. Permeability is moderate to slow. Chernozems formed under tall-grass prairie in temperate to cool subhumid climates. They occur in the Northern Great Plains Spring Wheat Land Resource Region and the Northwestern Wheat and Range Land Resource Region. Wheat is the main crop; flax, peas, oats, corn, and hay are important crops also. Some areas are in range.

Chestnut soils: These soils are closely related to Chernozems but occur in somewhat more arid climates. The surface layer is not so dark and is generally thinner, the entire solum is less thick, and the layer of calcium-carbonate accumulation is nearer the surface than in Chernozems. Textures are mainly loams, silt loams, and silty clay loams. Permeability is moderate to slow. Chestnut soils formed under mid grasses in temperate to cool, subhumid to semiarid climates. They are mainly in the western Great Plains and on plains and plateaus in the Northwest. Wheat production under dryfarming methods and range are the major uses.

Desert soils: These soils have a neutral to mildly alkaline light-colored surface layer that is low in organic matter, a transitional subsoil layer similar to the surface layer or darker in color and higher in clay, and a layer of calcium-carbonate accumulation at a depth of 1 to 3 feet. Textures are mainly sandy loams, loams, and silt loams. Permeability is moderate to slow. Desert soils formed in light-colored parent materials under a sparse shrub cover in cool to temperate arid climates. They occur in valleys, basins, and plains throughout the West. They are used mostly for range and have a very low carrying capacity. Where water is available for irrigation, they are used for many kinds of irrigated crops.

Gray-Brown Podzolic soils: These soils have a leached light-colored surface layer, a brown subsoil that contains more clay than the surface layer and has blocklike structure, and light-colored parent material at 2 to 5 feet. They are acid throughout but less so than Red-Yellow Podzolic soils and Podzols. Surface textures range from sandy loam to silty clay loam. Permeability is moderate to slow. Gray-Brown Podzolic soils formed under hardwood forest in a temperate humid climate. They are the major soils in the States bordering the southern Great Lakes. Formerly forested, they are now mostly cleared and used for growing feed grains, hay, wheat, and many other crops.

Gray Wooded soils: These soils are closely related to Gray-Brown Podzolic soils but occur in cooler climates. The surface layer is lighter colored and the subsoil is duller brown than that in Gray-Brown Podzolic soils. Gray Wooded soils commonly have a layer of calcium-carbonate accumulation at a depth of 3 to 5 feet. Surface textures are mainly loams, silt loams, and silty clay loams. Permeability is moderate to slow. Gray Wooded soils formed under hardwood or mixed forest in cool humid to slightly subhumid climate. They occur mainly in the northern Great Lakes States and on forested slopes of the Rocky Mountains. Much of the area in these soils remains in forest, but some areas are cleared and used for growing forage and grain for dairy cattle and other livestock.

Ground-Water Podzols: These soils similar to Podzols formed on wet lowlands. They have a thick leached acid sandy surface layer; a black or dark-brown slowly permeable subsoil in which there is an accumulation of organic matter and oxides of iron and aluminum; and gray wet sandy parent materials. Surface textures are sands or loamy sands, and the soils are naturally waterlogged. Where undisturbed, they have an acid organic surface mat. Groundwater Podzols formed under forest in cool to tropical humid climates. They are most extensive on the lower Atlantic and Gulf Coastal Plains and in the northern Great Lakes States. Most areas of these soils remain in forest but some areas are cleared and used for pasture and cropland.

Grumusols: These clay soils exhibit strong evidence of shrinking and swelling and of local mass movement of material within the profile. They have a black or dark-brown thick clay surface layer over lighter colored parent material that is also high in clay and is calcareous in some places. Surface textures are mainly clay and silty clay. Permeability is slow. On drying, these soils crack deeply. Grumusols formed under grass or open savanna in warm to cool regions that have marked wet and dry seasons. They are most extensive in the southern Great Plains, but they also occur in other parts of the west. They are used mainly for grazing and also for growing cotton and feed grains.

Humic Gley soils: These soils are dark colored and naturally waterlogged. They have a thick black surface layer high in organic matter over a gray or mottled subsoil or parent material. They range in surface texture from loam to clay. Typically Humic Gley soils formed in a subhumid cool or warm temperate climate, but they extend into the humid regions. The native vegetation is either herbaceous plants or swamp forest. These soils are most wide-

spread in flats and depressions in the Middle West, but they are also on flood plains of the Mississippi River. Where undrained, they are in meadow or forest, but large areas have been drained and are used for growing corn, hay, feed crops, and, on the Mississippi River Delta, cotton.

Lithosols: These soils are shallow over bedrock, are commonly stony, and have no evident genetically related soil layers. They vary widely in surface texture, depending on the nature of the underlying rocks. They are mostly rapidly permeable. Lithosols formed under many kinds of natural vegetation and in many kinds of climate. They are extensive on steep mountain slopes and on steep parts of dissected plains and plateaus, especially in semiarid and arid regions. Most of their area remains in their native vegetation.

Noncalcic Brown soils: These soils have a light- to medium-colored surface layer that is very hard when dry and low in organic matter. The subsoil is yellowish brown to red and high in clay; the parent material is lighter colored. Some of these soils have a hardpan below the subsoil. Noncalcic Brown soils are generally less acid than Gray-Brown Podzolic soils. Surface textures range from sandy loam to silty clay loam. Permeability is moderate to slow. Noncalcic Brown soils formed under open woods, in which the understory is brush or grass, in a moderate to warm temperate, subhumid to semiarid climate that has marked wet and dry seasons. They are most extensive in the valleys and foothills of California, but they also occur in the southern Great Plains. Much of their area is in range or pasture, but some is used for crops.

Planosols: These soils have one or more layers sharply separated from a strongly contrasting adjacent layer. Typical Planosols have either a light- or dark-colored surface layer overlying a subsoil that is very high in clay (claypan) and is underlain by less clayey parent material. Others have a firm to compact brittle layer (fragipan) below a subsoil in which there is some accumulation of clay. Surface textures of Planosols are loams, silt loams, or silty clay loams. Permeability of the claypan or fragipan is slow. Planosols formed under either grass or forest in subhumid to humid, temperate to warm climates. They occur mostly in the southern part of the central States. They are used mostly for pasture and crops, but some areas remain in native grasses or woodland.

Podzols: These soils have a leached acid light-colored surface layer, a brown to black subsoil in which either oxides of iron and aluminum or organic matter, or both, have accumulated, and lighter colored sandy or loamy parent material. Where the parent material is loamy, a compact brittle layer (fragipan) lies between the subsoil layer and the parent material. Undisturbed areas have a thick surface mat of acid organic matter. Surface textures are sands, loamy sands, and sandy loams. Permeability is rapid in the soils that do not have a fragipan but is slow in those with a fragipan. Podzols formed in mostly cool humid climates, but some areas extend into warm regions. They occur in the forested regions that extend across the northern part of the United States. Much of their area remains in forest, and some formerly cleared areas are now reverting to forest. Cleared land is used for pasture or for the production of forage and some grain for dairy cattle.

Red Desert soils: These soils are similar to Desert soils, but they have redder colors and formed in a hot arid climate. They occur in the desert regions of the Southwest. They are used mostly for range, but where water is available, some areas are irrigated for crops.

Reddish-Brown Lateritic soils: These soils have a thick dark-red or brown surface layer, a more clayey reddish-brown to red subsoil, and a clayey red parent material. Surface textures are silt loams and silty clay loams. Permeability is moderate. Reddish-Brown Lateric soils formed in warm temperate to subtropical humid climates under hardwood forests. They extend throughout the Southeastern States. They are associated with Red-Yellow Podzolic soils, but they formed in less siliceous and more basic parent materials. They are also on mountains along the west coast. Undulating to hilly areas are among the soils preferred for cropland and pasture; steep areas remain in forest.

Reddish-Brown soils: These soils are similar to Brown soils, but they are redder and formed in a warmer climate. Reddish-Brown soils occur mainly in the southern Great Plains and are used for range and for the production of wheat, sorghum, and irrigated cotton.

Reddish Chestnut soils: These soils are similar to Chestnut soils. They formed in warmer climates and are reddish, especially in the subsoil. In the United States, they occur in the southern Great Plains. They are used for growing wheat, sorghum, and cotton and for range.

Reddish Prairie soils: These soils resemble Brunizems in most features but are reddish, mainly below the surface layer. They are of small total extent in the United States and are restricted to the eastern part of the southern Great Plains. They are used for growing cotton, corn, and sorghum and for range or pasture.

Red-Yellow Podzolic soils: These soils have a light-colored leached surface layer; a thick red, yellowish-red, or bright yellowish-brown subsoil that has an accumulation of clay and iron and aluminum oxides; and clayey but siliceous parent material that commonly has coarse reticulate patterns or streaks of contrasting colors. These soils commonly are strongly acid throughout. Surface textures are mainly sandy loams, silt loams, and silty clay loams. Permeability of the subsoil is moderate to slow. Red-Yellow Podzolic soils formed mainly under mixed forests in a warm temperate humid climate. They are the dominant soils throughout the southeast. They are extensively used for crops, pasture, and forestry.

Regosols: These young soils have no evident genetically related soil layers. They consist of deep

unconsolidated materials, such as sands, windblown silt (loess), or young glacial deposits. Most of these soils have rapid to moderate permeability. They occur throughout the United States, mainly in relatively small areas. Most of their area remains in native vegetation. Some gently sloping areas that have an adequate moisture supply are used for crops.

Rendzinas: These shallow to very shallow soils commonly contain rock fragments and have a gray to black surface layer overlying limestone or marl. Surface textures are mainly silty clay loams. Permeability is slow. Rendzinas formed in humid to subhumid, warm temperate climates under grass or scrubby forest in which the understory is grass. In the United States, they are of little total extent and occur mainly in small areas in the Southern States. They are used for pasture or remain in forest.

Sierozems: These soils are much like Desert soils, but commonly the soil layers are slightly thicker and the average depth to the layer of calcium-carbonate accumulation is slightly greater. Surface textures are mainly sandy loams, loams, and silt loams. Permeability is moderate to slow. Sierozems formed under a sparse cover of shrubs and bunch grasses in cool to temperate arid climates, but they receive a little more rainfall than Desert soils. They are in basins, valleys, plains, and plateaus throughout Western United States. They are used mainly for range, but some areas are irrigated for crops.

Solonchak soils: These soils have a layer that is high in soluble salts at or near the surface, but they have no other clearly expressed genetically related soil layers. Surface textures range from loams to silty clay loams. Permeability is moderate to slow, and in many places, the depth to water is no more than a few feet. Solonchak soils formed under salt-tolerant grasses and shrubs in cool to warm, arid to subhumid climates. They commonly occupy depressions, low terraces, or alluvial fans that receive seepage or runoff waters. In the United States, they are widespread in the Great Plains and in valleys and basins of the West. Many areas remain in native grasses or shrubs. These soils naturally are too salty for the common crops, but many areas can be reclaimed by adequate leaching and drainage.

Solonetz soils: These soils have a light to moderately dark thin surface layer that is underlain by a thick, dark-colored, hard, highly alkaline, clayey subsoil. In some places, the subsoil material is arranged in columns. Parent materials are lighter in color and in some places high in soluble salts. Surface textures are loams, silt loams, and silty clay loams. Permeability of the subsoil is slow. Solonetz soils formed under a sparse cover of grass or shrubs in a cool to warm, subhumid to arid climate. Typically they occur in small areas and are widespread throughout the Great Plains and in the valleys, basins, and plains of the West. They form unproductive spots (slick spots) in otherwise productive cropland or range.

Sols Bruns Acides: These soils have a nearly uniform brown color and uniform texture from the surface down to either a firm or compact brittle layer (fragipan), which is lighter in color and mottled, or the underlying parent material, which is lighter in color but similar in texture. These soils are usually strongly acid throughout, but in some places the parent material is calcareous at a depth of several feet. Textures are mainly loams and silt loams. Permeability is slow to moderate. Sols Bruns Acides formed in a cool temperate humid climate under hardwood forests. They occupy the transition area between Podzols and Gray-Brown Podzolic soils. In the United States, they are most widespread in the Appalachian plateaus and mountains, but there are some areas in the mountains of the West. Cleared areas are used mostly for pasture and for grazing forage for dairy cattle. Large areas remain in forest, and some formerly cleared areas are reverting to forest.

Yellowish-Brown Lateritic soils: These soils are similar to Reddish-Brown Lateritic soils except for being less red. In the United States, they occur only on mountains near the west coast.

TABLE 1.—*Approximate area and proportionate extent of land resource regions and major land resource areas in the United States*
[Area given to nearest 100 square miles and percentages to nearest tenth]

Land resource region and major land resource area	Area	Extent in region	Extent in United States
	Square miles	*Percent*	*Percent*
A. Northwestern Forest, Forage, and Specialty Crop Region:	68,700		2.3
1. Northern Pacific Coast Range and Valleys	7,200	10.5	.2
2. Willamette and Puget Sound Valleys	26,700	38.9	.9
3. Olympic and Cascade Mountains (Western Slope)	18,400	26.8	.6
4. California Coastal Redwood Belt	4,200	6.1	.1
5. Siskiyou-Trinity Area	12,200	17.8	.4
B. Northwestern Wheat and Range Region:	97,600		3.3
6. Cascade Mountains (Eastern Slope)	17,200	17.6	.6
7. Columbia Basin	9,200	9.4	.3
8. Columbia Plateau	14,400	14.8	.5
9. Palouse and Nez Perce Prairies	9,200	9.4	.3
10. Upper Snake River Lava Plains and Hills	17,700	18.1	.6
11. Snake River Plains	16,200	16.6	.5
12. Lost River Valleys and Mountains	7,200	7.4	.2
13. Eastern Idaho Plateaus	6,500	6.7	.2
C. California Subtropical Fruit, Truck, and Specialty Crop Region:	66,100		2.2
14. Central California Valleys	5,200	7.9	.2
15. Central California Coast Range	15,900	24.1	.5
16. California Delta	700	1.1	—
17. Sacramento and San Joaquin Valleys	18,200	27.5	.6
18. Sierra Nevada Foothills	9,200	13.9	.3
19. Southern California Coastal Plain	7,200	10.9	.2
20. Southern California Mountains	9,700	14.7	.3
D. Western Range and Irrigated Region:	545,200		18.3
21. Klamath and Shasta Valleys and Basins	14,700	2.7	.5
22. Sierra Nevada Range	22,200	4.1	.7
23. Malheur High Plateau	28,300	5.2	1.0
24. Humboldt Area	10,700	2.0	.4
25. Owyhee High Plateau	24,700	4.5	.8
26. Carson Basin and Mountains	7,500	1.4	.3
27. Fallon-Lovelock Area	12,200	2.2	.4
28. Great Salt Lake Area	61,800	11.3	2.1
29. Southern Nevada Basin and Range	22,900	4.2	.8
30. Sonoran Basin and Range	61,800	11.3	2.1
31. Imperial Valley	2,500	.5	.1
32. Northern Intermountain Desertic Basins	9,000	1.7	.3
33. Semiarid Rocky Mountains	6,500	1.2	1.2
34. Central Desertic Basins, Mountains, and Plateaus	45,600	8.4	1.5
49. Southern Rocky Mountain Foothills	1,000	.2	—
35. Colorado and Green Rivers Plateaus	42,600	7.8	1.4
36. New Mexico and Arizona Plateaus and Mesas	26,200	4.8	.9
37. San Juan River Valley Mesas and Plateaus	4,700	.9	.2
38. Black, Hualpai, and Cerbat Mountains	6,500	1.2	.2
39. Arizona and New Mexico Mountains	35,100	6.4	1.2
40. Central Arizona Basin and Range	19,000	3.5	.6
41. Southeastern Arizona Basin and Range	17,700	3.2	.6
42. Southern Desertic Basins, Plains, and Mountains	62,000	11.4	2.1
E. Rocky Mountain Range and Forest Region:	236,800		8.0
43. Northern Rocky Mountains	100,000	42.2	3.4
44. Northern Rocky Mountain Valleys	16,200	6.8	.5
45. Alpine Meadows and Rockland	10,700	4.5	.4
46. Northern Rocky Mountain Foothills	23,000	9.7	.8
47. Wasatch and Uinta Mountains	22,000	9.3	.7
48. Southern Rocky Mountains	54,300	22.9	1.8
49. Southern Rocky Mountain Foothills	4,700	2.0	.2
50. San Luis Valley	1,200	.5	—
51. High Intermountain Valleys	4,700	2.0	.2
F. Northern Great Plains Spring Wheat Region:	131,100		4.4
52. Brown Glaciated Plain	19,700	15.0	.7
53. Dark Brown Glaciated Plain	29,100	22.2	1.0
54. Rolling Soft Shale Plain	21,700	16.5	.7
55. Black Glaciated Plains	41,400	31.6	1.4
56. Red River Valley of the North	15,700	12.0	.5
57. Western Minnesota Forest-Prairie Transition	3,500	2.7	.1

TABLE 1.—*Approximate area and proportionate extent of land resource regions and major land resource areas in the United States*—Continued
[Area given to nearest 100 square miles and percentages to nearest tenth]

Land resource region and major land resource area	Area	Extent in region	Extent in United States
	Square miles	*Percent*	*Percent*
G. Western Great Plains Range and Irrigated Region:	217,600		7.3
58. Northern Rolling High Plains	66,400	30.5	2.2
59. Northern Smooth High Plains	9,000	4.1	.3
60. Pierre Shale Plains and Badlands	13,500	6.2	.5
61. Black Hills Foot Slopes	5,200	2.4	.2
62. Black Hills	2,200	1.0	.1
63. Rolling Pierre Shale Plains	13,700	6.3	.5
64. Mixed Sandy and Silty Tableland	5,700	2.6	.2
65. Nebraska Sand Hills	20,000	9.2	.7
66. Dakota-Nebraska Eroded Tableland	4,700	2.2	.2
67. Central High Plains	33,100	15.2	1.1
68. Irrigated Upper Platte River Valley	3,000	1.4	.1
69. Upper Arkansas Valley Rolling Plains	12,200	5.6	.4
70. Pecos-Canadian Plains and Valleys	28,900	13.3	1.0
H. Central Great Plains Winter Wheat and Range Region:	219,900		7.4
71. Central Nebraska Loess Hills	8,000	3.6	.3
72. Central High Tableland	33,900	15.4	1.1
73. Rolling Plains and Breaks	17,700	8.0	.6
74. Central Kansas Sandstone Hills	4,700	2.1	.2
75. Central Loess Plains	13,700	6.2	.5
76. Bluestem Hills	10,200	4.6	.3
77. Southern High Plains	50,300	22.9	1.7
78. Central Rolling Red Plains	51,800	23.6	1.7
79. Great Bend Sand Plains	4,200	1.9	.1
80. Central Rolling Red Prairies	25,400	11.6	.9
I. Southwestern Plateaus and Plains Range and Cotton Region:	68,000		2.3
81. Edwards Plateau	33,100	48.7	1.1
82. Texas Central Basin	3,000	4.4	.1
83. Rio Grande Plain	31,900	46.9	1.1
J. Southwestern Prairies Cotton and Forage Region:	63,300		2.1
84. Cross Timbers	17,700	28.0	.6
85. Grand Prairie	12,700	20.1	.4
86. Texas Blackland Prairie	19,700	31.1	.7
87. Texas Claypan Area	13,200	20.9	.4
K. Northern Lake States Forest and Forage Region:	103,200		3.5
88. Northern Minnesota Swamps and Lakes	20,700	20.1	.7
89. Minnesota Rockland Hills	3,500	3.4	.1
90. Central Wisconsin and Minnesota Thin Loess and Till	26,200	25.4	.9
91. Wisconsin and Minnesota Sandy Outwash	8,000	7.8	.3
92. Superior Lake Plain	3,000	2.9	.1
93. Northern Michigan and Wisconsin Stony, Sandy, and Rocky Plains and Hills	21,400	20.7	.7
94. Northern Michigan Sandy Drift	20,400	19.8	.7
L. Lake States Fruit, Truck, and Dairy Region:	61,200		2.1
95. Southeastern Wisconsin Drift Plain	14,200	23.2	.5
96. Western Michigan Fruit Belt	2,500	4.1	.1
97. Southwestern Michigan Fruit and Truck Belt	1,700	2.8	.1
98. Southern Michigan Drift Plain	17,200	28.1	.6
99. Erie-Huron Lake Plain	12,200	19.9	.4
100. Erie Fruit and Truck Area	2,700	4.4	.1
101. Ontario-Mohawk Plain	10,700	17.5	.4
M. Central Feed Grains and Livestock Region:	283,900		9.6
102. Loess, Till, and Sandy Prairies	35,100	12.4	1.2
103. Central Iowa and Minnesota Till Prairies	27,900	9.8	.9
104. Eastern Iowa and Minnesota Till Prairies	9,700	3.4	.3
105. Northern Mississippi Valley Loess Hills	18,400	6.5	.6
106. Nebraska and Kansas Loess-Drift Hills	10,200	3.6	.3
107. Iowa and Missouri Deep Loess Hills	19,200	6.8	.6
108. Illinois and Iowa Deep Loess and Drift	34,900	12.3	1.2
109. Iowa and Missouri Heavy Till Plain	17,900	6.3	.6
110. Northern Illinois and Indiana Heavy Till Plain	7,700	2.7	.3
111. Indiana and Ohio Till Plain	32,900	11.6	1.1
112. Cherokee Prairies	25,400	8.9	.9
113. Central Claypan Areas	11,000	3.9	.4
114. Southern Illinois and Indiana Thin Loess and Till Plain	14,400	5.1	.5
115. Central Mississippi Valley Wooded Slopes	19,200	6.8	.6

TABLE 1.—*Approximate area and proportionate extent of land resource regions and major land resource areas in the United States*—Continued
[Area given to nearest 100 square miles and percentages to nearest tenth]

Land resource region and major land resource area	Area	Extent in region	Extent in United States
	Square miles	*Percent*	*Percent*
N. East and Central General Farming and Forest Region:	236,500		8.0
112. Cherokee Prairies	1,000	.4	—
116. Ozark Highland	34,400	14.5	1.2
117. Boston Mountains	6,200	2.6	.2
118. Arkansas Valley and Ridges	7,000	3.0	.2
119. Ouachita Mountains	11,700	4.9	.4
120. Kentucky and Indiana Sandstone and Shale Hills and Valleys	11,200	4.7	.4
121. Kentucky Bluegrass	11,000	4.7	.4
122. Highland Rim and Pennyroyal	22,700	9.6	.8
123. Nashville Basin	5,700	2.4	.2
124. Western Allegheny Plateau	8,200	3.5	.3
125. Cumberland Plateau and Mountains	25,900	10.9	.9
126. Central Allegheny Plateau	19,400	8.2	.7
127. Eastern Allegheny Plateau and Mountains	15,900	6.7	.5
128. Southern Appalachian Ridges and Valleys	28,600	12.1	1.0
129. Sand Mountain	8,700	3.7	.3
130. Blue Ridge	18,900	8.0	.6
O. Mississippi Delta Cotton and Feed Grains Region:	45,600		1.5
131. Southern Mississippi Valley Alluvium	36,600	80.3	1.2
132. Eastern Arkansas Prairies	7,000	15.3	.2
134. Southern Mississippi Valley Silty Uplands	2,000	4.4	.1
P. South Atlantic and Gulf Slope Cash Crop, Forest, and Livestock Region:	250,200		8.4
86. Texas Blackland Prairie	700	.3	—
133. Southern Coastal Plain	145,300	58.1	4.9
134. Southern Mississippi Valley Silty Uplands	24,000	9.6	.8
135. Alabama and Mississippi Blackland Prairies	9,000	3.6	.3
136. Southern Piedmont	59,000	23.6	2.0
137. Carolina and Georgia Sand Hills	8,200	3.3	.3
138. North Central Florida Ridge	4,000	1.6	.1
R. Northeastern Forage and Forest Region:	121,600		4.1
139. Eastern Ohio Till Plain	6,500	5.3	.2
140. Glaciated Allegheny Plateau and Catskill Mountains	27,400	22.5	.9
141. Tughill Plateau	1,500	1.2	.1
142. St. Lawrence-Champlain Plain	7,000	5.8	.2
143. Northeastern Mountains	36,900	30.3	1.2
144. New England and Eastern New York Upland	38,100	31.3	1.3
145. Connecticut Valley	1,700	1.4	.1
146. Aroostook Area	2,500	2.1	.1
S. Northern Atlantic Slope Truck, Fruit, and Poultry Region:	44,100		1.5
147. Northern Appalachian Ridges and Valleys	15,700	35.6	.5
148. Northern Piedmont	15,200	34.5	.5
149. Northern Coastal Plain	13,200	29.9	.4
T. Atlantic and Gulf Coast Lowlands Forest and Truck Crop Region:	77,200		2.6
150. Gulf Coast Prairies	15,900	20.6	.5
151. Gulf Coast Marsh	8,000	10.4	.3
152. Gulf Coast Flatwoods	10,500	13.6	.4
153. Atlantic Coast Flatwoods	42,800	55.4	1.4
U. Florida Subtropical Fruit, Truck Crop, and Range Region:	33,600		1.1
154. South-Central Florida Ridge	8,500	25.3	.3
155. Southern Florida Flatwoods	17,900	53.3	.6
156. Florida Everglades and Associated Areas	7,200	21.4	.2
Total	2,971,400		

TABLE 2.—*Approximate equivalents of great soil groups of the modified 1938 Yearbook classification in the classes in Soil Taxonomy*

1938 classification [1]	Soil Taxonomy [2]	
Great soil groups	Most nearly corresponding taxa	Less common corresponding taxa
Alluvial soils	Fluvaquents Fluvents Fluventic subgroups of Inceptisols.	
Alpine Meadow soils	Cryaquods	Cryaquolls. Cryumbrepts.
Ando soils	Dystrandepts	Other great groups of Andepts.
Bog soils	Histosols	Histic subgroups of Aqualfs, Aquepts, and Aquolls.
Brown soils	Borolls (aridic subgroups) Ustolls (aridic subgroups) Xerolls (aridic subgroups) Aridisols (mollic subgroups)	Aridic Haploborolls. Durixerolls.
Brown Forest soils	Eutrochrepts	Haploxerolls. Hapludolls.
Brown Podzolic soils	Entic Haplorthods Entic Fragiorthods Cryandepts	Dystrochrepts. Fragiochrepts.
Brunizems (Prairie soils)	Udolls Argixerolls (typic subgroups) Haploxerolls (typic subgroups)	Udic Argiustolls.
Calcisols	Mollisols (calcic great groups) Aridisols (calcic great groups)	Ustochrepts. Xerochrepts.
Chernozem soils	Borolls (udic subgroups) Ustolls (udic subgroups)	Haploxerolls. Mollic Eutroboralfs. Boralfic Argiborolls.
Chestnut soils	Borolls (typic subgroups) Ustolls (typic subgroups)	Xerolls.
Desert soils	Aridisols (mesic and frigid families).	
Gray-Brown Podzolic soils	Udalfs	Aeric Ochraqualfs. Hapludults.
Gray Wooded soils	Boralfs	
Ground-Water Podzols	Aquods	Haplohumods.
Grumusols	Vertisols	Haplaquepts (vertic subgroups). Haplaquolls (vertic subgroups). Rendolls.
Humic Gley soils	Umbraqualfs Aquolls Humaquepts	Andaquepts. Haplaquepts (mollic subgroups). Ochraqualfs (mollic subgroups). Paleaquults (umbric subgroups).
Lithosols	Orthents (lithic subgroups) Psamments (lithic subgroups)	Lithic subgroups of Alfisols, Aridisols, Inceptisols, Mollisols, and Ultisols.
Low-Humic Gley soils	Aquents Aquepts Aquults	Aqualfs. Paleaquults. Psammaquents.
Noncalcic Brown soils	Xeralfs	Xerochrepts.

See footnotes at end of table,

TABLE 2.—*Approximate equivalents of great soil groups of the modified 1938 Yearbook classification in the classes in Soil Taxonomy*—Continued

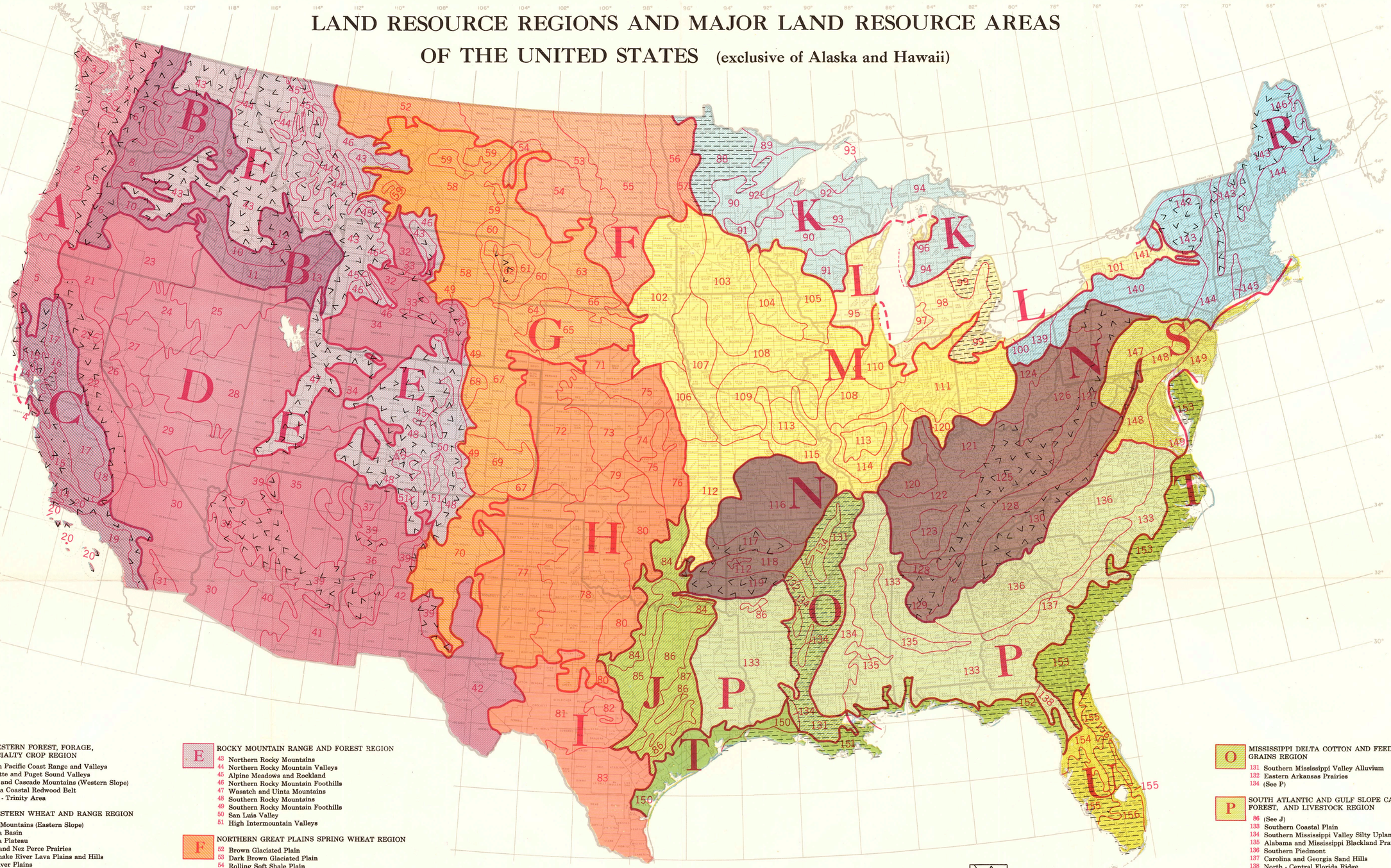
1938 classification [1]	Soil Taxonomy [2]	
Great soil groups	Most nearly corresponding taxa	Less common corresponding taxa
Planosols	Albaquults Albaqualfs Albolls	Fragiaquults. Paleaquults.
Podzols	Orthods	Haplohumods. Dystrochrepts. Fragiochrepts.
Red Desert soils	Aridisols (thermic and hyperthermic families).	
Reddish-Brown Lateritic soils	Humults Rhodudults	Rhodic Paleudalfs. Rhodic Paleudults.
Reddish-Brown soils	Haplustalfs Paleustalfs Ustollic Haplargids	Aridic Argiustolls (thermic and hyperthermic families). Aridic Calciustolls (thermic and hyperthermic families). Aridic Haplustolls (thermic and hyperthermic families).
Reddish Chestnut soils	Haplustalfs Paleustalfs Typic and Aridic Argiustolls (thermic and hyperthermic families).	(warm) Haplustolls.
Reddish Prairie soils	Ustolls (udic subgroups, thermic and hyperthermic families). Paleudolls (thermic and hyperthermic families).	Eutrandepts.
Red-Yellow Podzolic soils	Udults	Paleudalfs. Haplustalfs (ultic subgroups). Paleustalfs (ultic subgroups).
Regosols	Great groups of Psamments Orthents (not lithic)	Grossarenic Paleudults. Xerochrepts.
Rendzina soils	Rendolls	Hapludolls. Eutrochrepts.
Sierozems	Aridisols (mollic great groups, mesic and frigid families).	Aridic subgroups of Mollisols.
Solonchak soils	Salorthids Calciaquolls	Halaquepts. Aquic Calciustolls.
Solonetz soils	Natric great groups	Natric subgroups.
Sols Bruns Acides	Dystrochrepts Fragiochrepts Haplumbrepts	Udorthent. Xerumbrept.
Subarctic Brown Forest soils	Cryochrepts	Cryoborolls.
Yellowish-Brown Lateritic soils	Umbrihumults Haplumbrepts	

[1] Concepts of great soil groups are those given in the 1938 Yearbook of Agriculture pp. 996–1001 as modified in Soil Sci. 67: 117–126, 1949, and as modified in other publications and correlations prior to 1960.

[2] Soil Survey Staff, Soil Taxonomy. In preparation.

U.S. GOVERNMENT PRINTING OFFICE: 1972 O—453—983

LAND RESOURCE REGIONS AND MAJOR LAND RESOURCE AREAS OF THE UNITED STATES (exclusive of Alaska and Hawaii)



A NORTHWESTERN FOREST, FORAGE, AND SPECIALTY CROP REGION
- 1 Northern Pacific Coast Range and Valleys
- 2 Willamette and Puget Sound Valleys
- 3 Olympic and Cascade Mountains (Western Slope)
- 4 California Coastal Redwood Belt
- 5 Siskiyou - Trinity Area

B NORTHWESTERN WHEAT AND RANGE REGION
- 6 Cascade Mountains (Eastern Slope)
- 7 Columbia Basin
- 8 Columbia Plateau
- 9 Palouse and Nez Perce Prairies
- 10 Upper Snake River Lava Plains and Hills
- 11 Snake River Plains
- 12 Lost River Valleys and Mountains
- 13 Eastern Idaho Plateaus

C CALIFORNIA SUBTROPICAL FRUIT, TRUCK, AND SPECIALTY CROP REGION
- 14 Central California Valleys
- 15 Central California Coast Range
- 16 California Delta
- 17 Sacramento and San Joaquin Valleys
- 18 Sierra Nevada Foothills
- 19 Southern California Coastal Plain
- 20 Southern California Mountains

D WESTERN RANGE AND IRRIGATED REGION
- 21 Klamath and Shasta Valleys and Basins
- 22 Sierra Nevada Range
- 23 Malheur High Plateau
- 24 Humboldt Area
- 25 Owyhee High Plateau
- 26 Carson Basin and Mountains
- 27 Fallon - Lovelock Area
- 28 Great Salt Lake Area
- 29 Southern Nevada Basin and Range
- 30 Sonoran Basin and Range
- 31 Imperial Valley
- 32 Northern Intermountain Desertic Basins
- 33 Semiarid Rocky Mountains
- 34 Central Desertic Basins, Mountains, and Plateaus
- 49 (See E)
- 35 Colorado and Green Rivers Plateaus
- 36 New Mexico and Arizona Plateaus and Mesas
- 37 San Juan River Valley Mesas and Plateaus
- 38 Black, Hualpai, and Cerbat Mountains
- 39 Arizona and New Mexico Mountains
- 40 Central Arizona Basin and Range
- 41 Southeastern Arizona Basin and Range
- 42 Southern Desertic Basins, Plains, and Mountains

E ROCKY MOUNTAIN RANGE AND FOREST REGION
- 43 Northern Rocky Mountains
- 44 Northern Rocky Mountain Valleys
- 45 Alpine Meadows and Rockland
- 46 Northern Rocky Mountain Foothills
- 47 Wasatch and Uinta Mountains
- 48 Southern Rocky Mountains
- 49 Southern Rocky Mountain Foothills
- 50 San Luis Valley
- 51 High Intermountain Valleys

F NORTHERN GREAT PLAINS SPRING WHEAT REGION
- 52 Brown Glaciated Plain
- 53 Dark Brown Glaciated Plain
- 54 Rolling Soft Shale Plain
- 55 Black Glaciated Plains
- 56 Red River Valley of the North
- 57 Western Minnesota Forest - Prairie Transition

G WESTERN GREAT PLAINS RANGE AND IRRIGATED REGION
- 58 Northern Rolling High Plains
- 59 Northern Smooth High Plains
- 60 Pierre Shale Plains and Badlands
- 61 Black Hills Foot Slopes
- 62 Black Hills
- 63 Rolling Pierre Shale Plains
- 64 Mixed Sandy and Silty Tableland
- 65 Nebraska Sand Hills
- 66 Dakota - Nebraska Eroded Tableland
- 67 Central High Plains
- 68 Irrigated Upper Platte River Valley
- 69 Upper Arkansas Valley Rolling Plains
- 70 Pecos - Canadian Plains and Valleys

H CENTRAL GREAT PLAINS WINTER WHEAT AND RANGE REGION
- 71 Central Nebraska Loess Hills
- 72 Central High Tableland
- 73 Rolling Plains and Breaks
- 74 Central Kansas Sandstone Hills
- 75 Central Loess Plains
- 76 Bluestem Hills
- 77 Southern High Plains
- 78 Central Rolling Red Plains
- 79 Great Bend Sand Plains
- 80 Central Rolling Red Prairies

I SOUTHWESTERN PLATEAUS AND PLAINS RANGE AND COTTON REGION
- 81 Edwards Plateau
- 82 Texas Central Basin
- 83 Rio Grande Plain

J SOUTHWESTERN PRAIRIES COTTON AND FORAGE REGION
- 84 Cross Timbers
- 85 Grand Prairie
- 86 Texas Blackland Prairie
- 87 Texas Claypan Area

K NORTHERN LAKE STATES FOREST AND FORAGE REGION
- 88 Northern Minnesota Swamps and Lakes
- 89 Minnesota Rockland Hills
- 90 Central Wisconsin and Minnesota Thin Loess and Till
- 91 Wisconsin and Minnesota Sandy Outwash
- 92 Superior Lake Plain
- 93 Northern Michigan and Wisconsin Stony, Sandy, and Rocky Plains and Hills
- 94 Northern Michigan Sandy Drift

L LAKE STATES FRUIT, TRUCK, AND DAIRY REGION
- 95 Southeastern Wisconsin Drift Plain
- 96 Western Michigan Fruit Belt
- 97 Southwestern Michigan Fruit and Truck Belt
- 98 Southern Michigan Drift Plain
- 99 Erie - Huron Lake Plain
- 100 Erie Fruit and Truck Area
- 101 Ontario - Mohawk Plain

M CENTRAL FEED GRAINS AND LIVESTOCK REGION
- 102 Loess, Till, and Sandy Prairies
- 103 Central Iowa and Minnesota Till Prairies
- 104 Eastern Iowa and Minnesota Till Prairies
- 105 Northern Mississippi Valley Loess Hills
- 106 Nebraska and Kansas Loess - Drift Hills
- 107 Iowa and Missouri Deep Loess Hills
- 108 Illinois and Iowa Deep Loess and Drift
- 109 Iowa and Missouri Heavy Till Plain
- 110 Northern Illinois and Indiana Heavy Till Plain
- 111 Indiana and Ohio Till Plain
- 112 Cherokee Prairies
- 113 Central Claypan Areas
- 114 Southern Illinois and Indiana Thin Loess and Till Plain
- 115 Central Mississippi Valley Wooded Slopes

N EAST AND CENTRAL GENERAL FARMING AND FOREST REGION
- 112 (See M)
- 116 Ozark Highland
- 117 Boston Mountains
- 118 Arkansas Valley and Ridges
- 119 Ouachita Mountains
- 120 Kentucky and Indiana Sandstone and Shale Hills and Valleys
- 121 Kentucky Bluegrass
- 122 Highland Rim and Pennyroyal
- 123 Nashville Basin
- 124 Western Allegheny Plateau
- 125 Cumberland Plateau and Mountains
- 126 Central Allegheny Plateau
- 127 Eastern Allegheny Plateau and Mountains
- 128 Southern Appalachian Ridges and Valleys
- 129 Sand Mountain
- 130 Blue Ridge

O MISSISSIPPI DELTA COTTON AND FEED GRAINS REGION
- 131 Southern Mississippi Valley Alluvium
- 132 Eastern Arkansas Prairies
- 134 (See P)

P SOUTH ATLANTIC AND GULF SLOPE CASH CROP, FOREST, AND LIVESTOCK REGION
- 86 (See J)
- 133 Southern Coastal Plain
- 134 Southern Mississippi Valley Silty Uplands
- 135 Alabama and Mississippi Blackland Prairies
- 136 Southern Piedmont
- 137 Carolina and Georgia Sand Hills
- 138 North - Central Florida Ridge

R NORTHEASTERN FORAGE AND FOREST REGION
- 139 Eastern Ohio Till Plain
- 140 Glaciated Allegheny Plateau and Catskill Mountains
- 141 Tughill Plateau
- 142 St. Lawrence - Champlain Plain
- 143 Northeastern Mountains
- 144 New England and Eastern New York Upland
- 145 Connecticut Valley
- 146 Aroostook Area

S NORTHERN ATLANTIC SLOPE TRUCK, FRUIT, AND POULTRY REGION
- 147 Northern Appalachian Ridges and Valleys
- 148 Northern Piedmont
- 149 Northern Coastal Plain

T ATLANTIC AND GULF COAST LOWLAND FOREST AND TRUCK CROP REGION
- 150 Gulf Coast Prairies
- 151 Gulf Coast Marsh
- 152 Gulf Coast Flatwoods
- 153 Atlantic Coast Flatwoods

U FLORIDA SUBTROPICAL FRUIT, TRUCK CROP, AND RANGE REGION
- 154 South - Central Florida Ridge
- 155 Southern Florida Flatwoods
- 156 Florida Everglades and Associated Areas

Mountains

Wet Land

SCALE 1:10000000

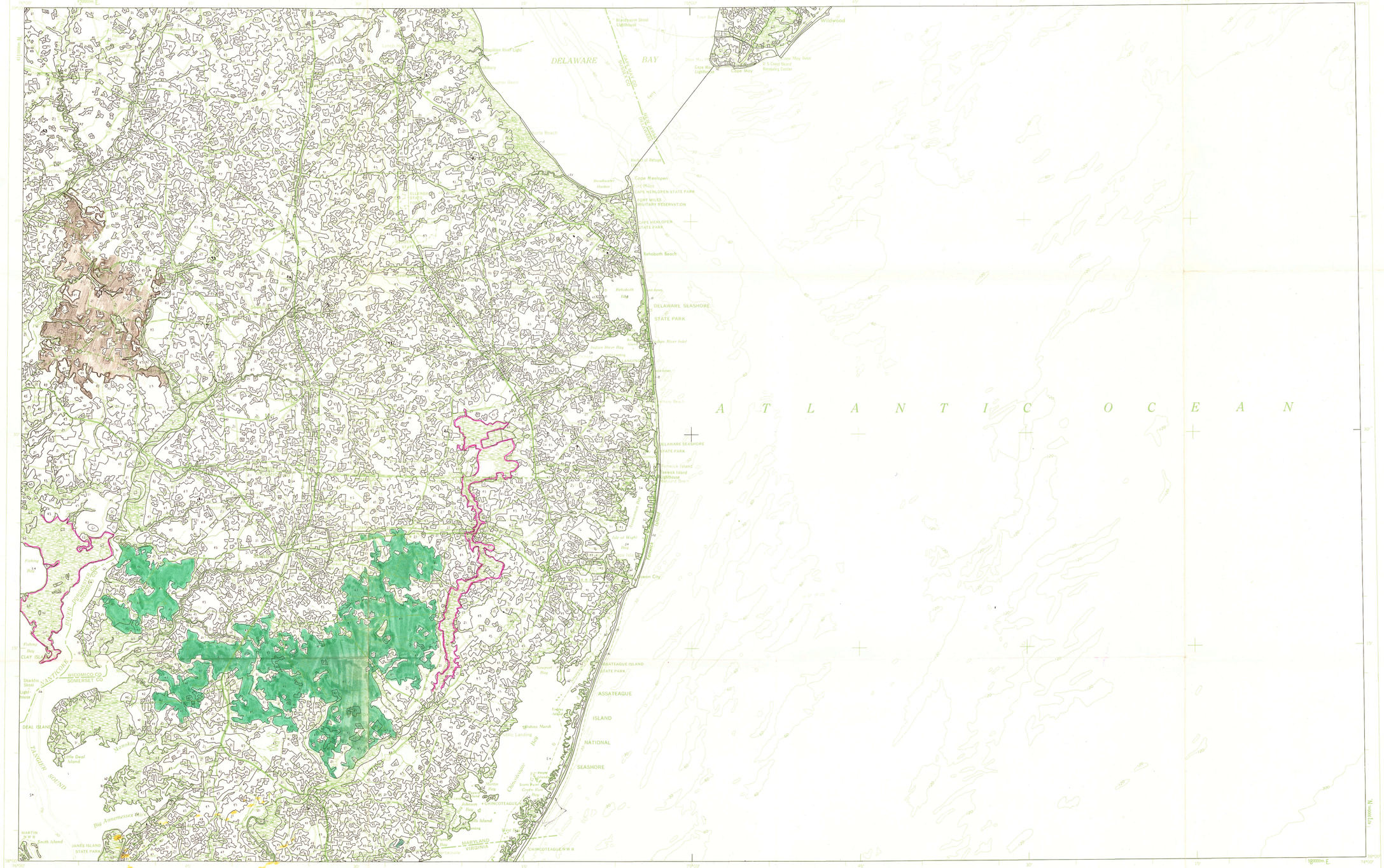
50 0 50 100 150 200 250 300 Miles

USDA-SCS-HYATTSVILLE, MD. 1970

January 1963
Slightly revised August 1965

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

LAND USE SERIES
MAP L-65
LAND USE AND LAND COVER, 1973
SALISBURY, MD.; DEL.; N. J.; VA.


DELAWARE BAY
ATLANTIC OCEAN
Cape Henlopen
CAPE HENLOPEN STATE PARK
CAPE MAY-LEWES FERRY
Rehoboth Beach
DELAWARE SEASHORE STATE PARK
ASSATEAGUE ISLAND NATIONAL SEASHORE
ASSATEAGUE ISLAND STATE PARK
CHINCOTEAGUE NWR
Ocean City
Wildwood
Fishing Bay
CLAY ISLAND
WICOMICO CO
SOMERSET CO
DEAL ISLAND
TANGIER SOUND
Little Deal Island
Janes Island
JANES ISLAND STATE PARK
MARYLAND
VIRGINIA
Big Annemessex R.
Smith Island
Assateague Island
Chincoteague
Wallops Island
Metompkin Island
Parramore Island
Hog Island
Cedar Island
Fishing Bay
Shanklin Shoal Light
Tangier Island
Watts Island
Monie
Manokin
Nanticoke R.
Pocomoke Sound
Sinepuxent Bay
Isle of Wight Bay
Indian River Bay
Rehoboth Bay
Indian River Inlet
Ocean City Inlet
Chincoteague Bay
Assateague Channel
Wachapreague
Quinby
Oyster
Hooper Island Light
Cape Charles Light
Cape Henlopen Light
Brandywine Shoal Lighthouse
Delaware Breakwater East End Light
Harbor of Refuge
Breakwater Harbor
Lewes
Rehoboth
Indian River Bay
Indian River Inlet
Roosevelt Inlet
Lewes-Cape May Ferry
Delaware Bay Channel
Cape May Inlet
Cape May Lighthouse
Cape May Point
Cape May
Coast Guard Station
U.S. Coast Guard Receiving Center
New Jersey
Delaware
Maryland
Virginia
Fishing Bay
Wetipquin
Quantico
Nanticoke
Whitehaven
Princess Anne
Somerset
Wicomico
Worcester
Accomack
Northampton
Sussex
Cape May
Atlantic
Cumberland
Salem
Gloucester
Camden
Burlington
Ocean
Monmouth
Kent
Queen Anne's
Talbot
Caroline
Dorchester
Somerset
Wicomico
Worcester
Accomack
Northampton
Sussex
Kent
New Castle
Cecil
Harford
Baltimore
Carroll
Frederick
Montgomery
Howard
Anne Arundel
Prince George's
Charles
St. Mary's
Calvert
Washington
Allegany
Garrett
Fairfax
Loudoun
Prince William
Arlington
Alexandria
Fauquier
Rappahannock
Culpeper
Orange
Madison
Greene
Albemarle
Fluvanna
Louisa
Goochland
Powhatan
Amelia
Nottoway
Dinwiddie
Prince George
Surry
Sussex
Isle of Wight
Southampton
Greensville
Brunswick
Lunenburg
Mecklenburg
Halifax
Pittsylvania
Henry
Patrick
Franklin
Floyd
Montgomery
Roanoke
Bedford
Campbell
Appomattox
Buckingham
Cumberland
Prince Edward
Charlotte
Lunenburg
Nottoway
Amelia
Powhatan
Chesterfield
Henrico
Hanover
New Kent
James City
York
Gloucester
Mathews
Middlesex
Essex
King William
King and Queen
Caroline
Spotsylvania
Stafford
Fredericksburg
Richmond
Petersburg
Hopewell
Colonial Heights
Chesapeake
Portsmouth
Suffolk
Virginia Beach
Norfolk
Newport News
Hampton
Williamsburg
Poquoson
Salisbury
Wilmington
Dover
Trenton
Camden
Atlantic City
Cape May
Vineland
Millville
Bridgeton
Glassboro
Woodbury
Gloucester City
Pleasantville
Egg Harbor City
Hammonton
Absecon
Somers Point
Ocean City
Wildwood
Cape May Court House
Cape May Point
Lewes
Rehoboth Beach
Dewey Beach
Bethany Beach
Fenwick Island
Ocean View
Millsboro
Georgetown
Seaford
Laurel
Delmar
Salisbury
Fruitland
Princess Anne
Crisfield
Pocomoke City
Snow Hill
Berlin
Ocean City
Chincoteague
Wallops Island
Onancock
Onley
Accomac
Parksley
Tangier
Cape Charles
Eastville
Nassawadox
Exmore
Cheriton
Kiptopeke
Norfolk
Portsmouth
Chesapeake
Suffolk
Virginia Beach
Newport News
Hampton
Williamsburg
Poquoson
Yorktown
Gloucester Point
Tappahannock
Urbanna
Saluda
Middlesex
Deltaville
Irvington
Kilmarnock
Lancaster
Reedville
Montross
Colonial Beach
Oak Grove
Dahlgren
King George
Fredericksburg
Spotsylvania
Stafford
Quantico
Dumfries
Manassas
Manassas Park
Alexandria
Arlington
Falls Church
Fairfax
Vienna
Herndon
Reston
Chantilly
Centreville
Leesburg
Purcellville
Middleburg
Warrenton
Culpeper
Orange
Gordonsville
Charlottesville
Scottsville
Louisa
Fluvanna
Goochland
Powhatan
Amelia
Nottoway
Dinwiddie
Prince George
Hopewell
Colonial Heights
Petersburg
Richmond

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

The West Virginia portion of this map was prepared in cooperation with the WEST VIRGINIA GEOLOGICAL AND ECONOMIC SURVEY

The Pennsylvania portion of this map was prepared in cooperation with the COMMONWEALTH OF PENNSYLVANIA, DEPARTMENT OF ENVIRONMENTAL RESOURCES

LAND USE SERIES
MAP L–113

LAND USE AND LAND COVER, 1974–76
BALTIMORE, MARYLAND; PENNSYLVANIA; VIRGINIA; WEST VIRGINIA

EXPLANATION

1 URBAN OR BUILT-UP LAND

11 Residential
12 Commercial and services
13 Industrial
14 Transportation, communications and utilities
15 Industrial and commercial complexes
16 Mixed urban or built-up land
17 Other urban or built-up land

2 AGRICULTURAL LAND

21 Cropland and pasture
22 Orchards, groves, vineyards, nurseries, and ornamental horticultural areas
23 Confined feeding operations
24 Other agricultural land

3 RANGELAND

31 Herbaceous rangeland
32 Shrub and brush rangeland
33 Mixed rangeland

4 FOREST LAND

41 Deciduous forest land
42 Evergreen forest land
43 Mixed forest land

5 WATER

51 Streams and canals
52 Lakes
53 Reservoirs
54 Bays and estuaries

6 WETLAND

61 Forested wetland
62 Nonforested wetland

7 BARREN LAND

71 Dry salt flats
72 Beaches
73 Sandy areas other than beaches
74 Bare exposed rocks
75 Strip mines, quarries, and gravel pits
76 Transitional areas
77 Mixed barren land

8 TUNDRA

81 Shrub and brush tundra
82 Herbaceous tundra
83 Bare ground tundra
84 Wet tundra
85 Mixed tundra

9 PERENNIAL SNOW OR ICE

91 Perennial snowfields
92 Glaciers

For definitions of Level I and Level II categories see U.S. Geological Survey Professional Paper 964, *A land use and land cover classification system for use with remote sensor data*, 1976, by J. R. Anderson, E. E. Hardy, J. T. Roach, and R. E. Witmer.

The development of a geographic information system incorporating digital land use data is described in U.S. Geological Survey Professional Paper 1059, *GIRAS: A geographic information retrieval and analysis system for handling land use and land cover data*, 1977, by W. B. Mitchell, S. C. Guptill, K. E. Anderson, R. G. Fegeas, and C. A. Hallam.

Land use and land cover information compiled from source materials dated 1974–76.

Minimum mapping units are: 4 hectares (10 acres) for Level II categories 11–17, 23–24, 51–54, 75, and urban occurrences of 76; and 16 hectares (40 acres) for all other Level II categories.

For compilation specifications see U.S. Geological Survey Open-file report 77–555, *Specifications for land use and land cover and associated maps*, 1977, by G. L. Loelkes, Jr.

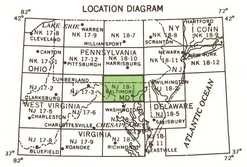
Compilation verified by field check.

Base from U.S. Geological Survey, 1957-69

25 SQUARE MILES
25 SQUARE KILOMETERS

SCALE 1:250 000
5 0 5 10 15 20 25 MILES
5 0 5 10 15 20 25 30 35 KILOMETERS

LOCATION DIAGRAM



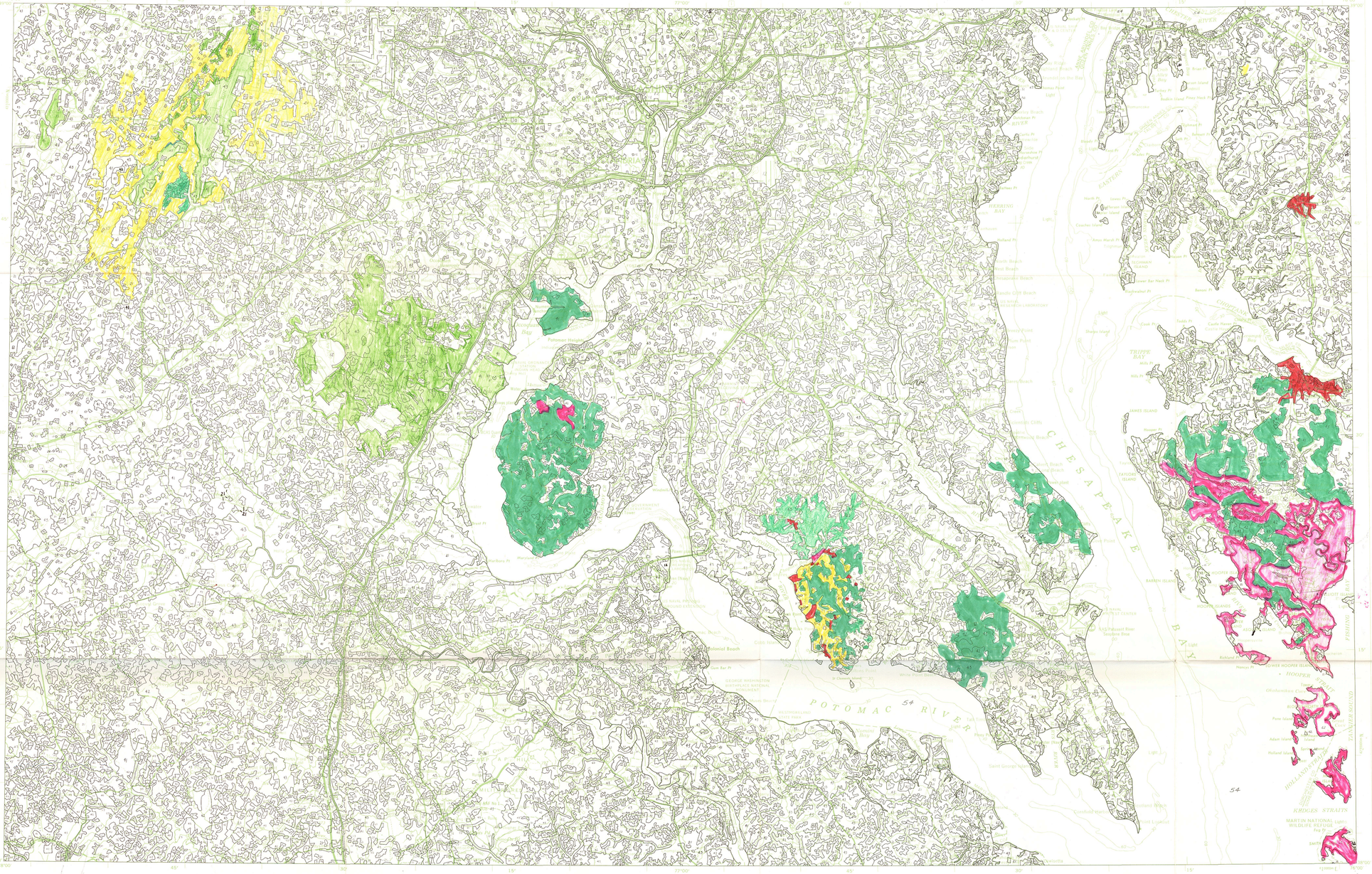
LAND USE AND LAND COVER, 1974–76
BALTIMORE, MARYLAND; PENNSYLVANIA; VIRGINIA; WEST VIRGINIA

INTERIOR—GEOLOGICAL SURVEY, RESTON, VA.—1981—785516

For sale by Branch of Distribution, U.S. Geological Survey, 1200 South Eads Street, Arlington, VA 22202

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

LAND USE SERIES
MAP L–201
LAND USE AND LAND COVER, 1972
WASHINGTON, D.C.; MARYLAND; VIRGINIA



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17 Other urban or built-up land

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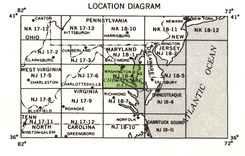
Base from U.S. Geological Survey, 1957-69

25 SQUARE MILES
25 SQUARE KILOMETERS

SCALE 1:250 000
5 0 5 10 15 20 25 MILES
5 0 5 10 15 20 25 30 35 KILOMETERS

LOCATION DIAGRAM



LAND USE AND LAND COVER, 1972
WASHINGTON, D.C.; MARYLAND; VIRGINIA

INTERIOR—GEOLOGICAL SURVEY, RESTON, VA.—1981—78535

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